

Blood, Sweat and Tears – The Changing  
Concepts of Physiology from Antiquity  
into Early Modern Europe

# Intersections

Interdisciplinary Studies in Early Modern Culture

*General Editor*

Karl A.E. Enenkel

Chair of Medieval and Neo-Latin Literature  
Westfälische Wilhelmsuniversität Münster  
e-mail: [kenen\\_01@uni\\_muenster.de](mailto:kenen_01@uni_muenster.de)

*Editorial Board*

W. van Anrooij (University of Leiden)

W. de Boer (Miami University)

K.A.E. Enenkel (University of Münster)

J.L. de Jong (University of Groningen)

W.S. Melion (Emory University)

K. Murphy (University of Oxford)

W. Neuber (NYU Abu Dhabi)

P.J. Smith (University of Leiden)

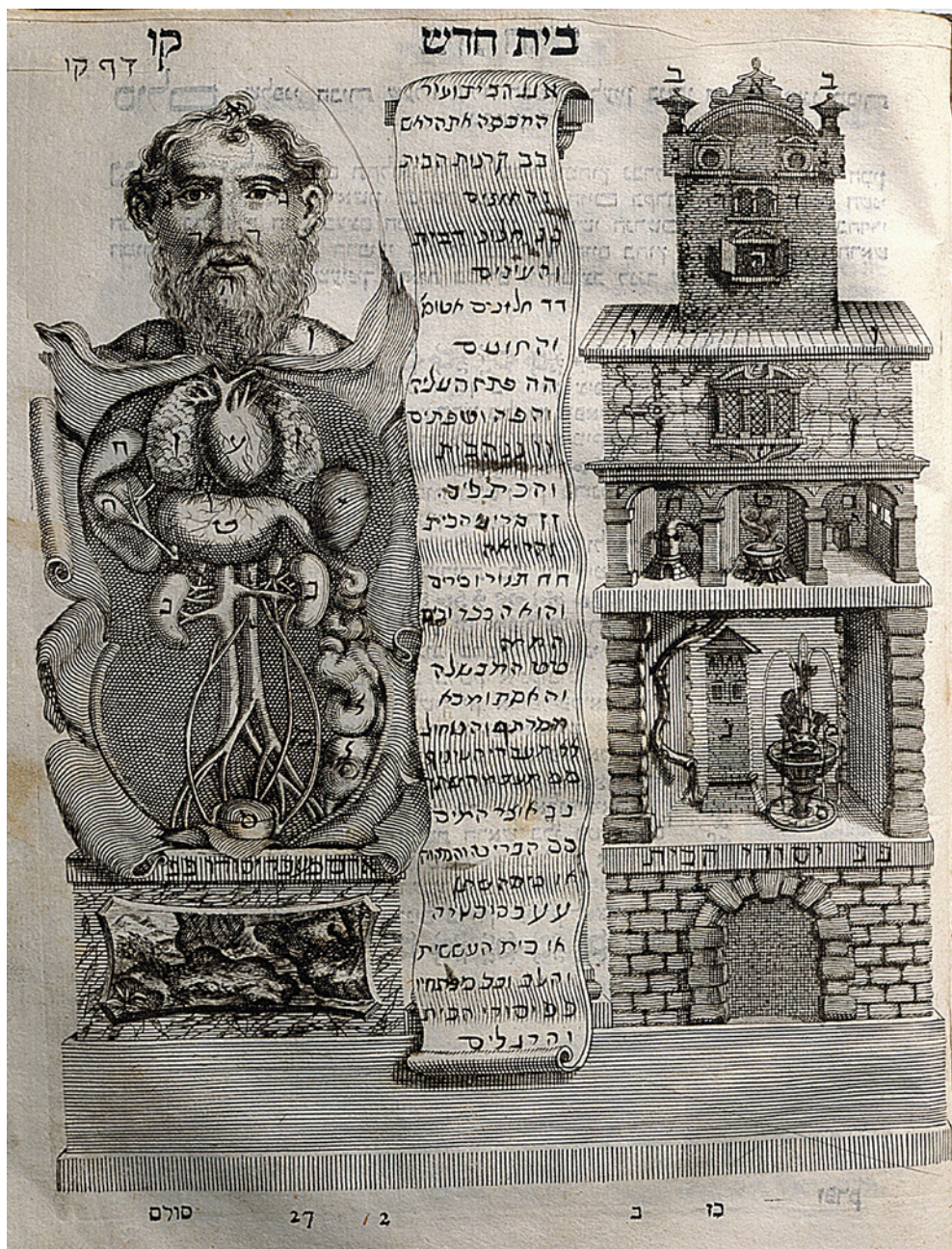
A. Traninger (Freie Universität Berlin)

C. Zittel (Freie Universität Berlin)

VOLUME 25 – 2012

*The titles published in this series are listed at [brill.nl/inte](http://brill.nl/inte)*





Tobias Cohn, *Ma'aseh Tobiyah* (*Work of Tobias*), published in Venice in 1708, illustrated the human body as a house (fol. 107 recto). The house of the body divides body space so that the head is the roof, the spleen the cellar, and the legs the foundations. The functions of the body are seen according to a thermodynamic model that uses comparisons with the apparatus of distillation.



# Blood, Sweat and Tears – The Changing Concepts of Physiology from Antiquity into Early Modern Europe

*Edited by*

Manfred Horstmanshoff, Helen King  
and Claus Zittel



BRILL

LEIDEN • BOSTON  
2012

*Cover illustration:* Tobias Cohn, Ma'aseh Tobiyah (*Work of Tobias*), published in Venice in 1708. See Introduction 9.

Library of Congress Cataloging-in-Publication Data

Blood, sweat, and tears : the changing concepts of physiology from antiquity into early modern europe / edited by Manfred Horstmanshoff, Helen King, and Claus Zittel.

p. cm. — (Intersections ; 25)

Includes index.

ISBN 978-90-04-22918-1 (hardback : alk. paper) — ISBN 978-90-04-22920-4 (e-book) 1. Medicine, Ancient. 2. Medicine—History. 3. Physiology—History. I. Horstmanshoff, H. F. J. II. King, Helen, 1957– III. Zittel, Claus.

R135.B56 2012

610—dc23

2012010504

This publication has been typeset in the multilingual “Brill” typeface. With over 5,100 characters covering Latin, IPA, Greek, and Cyrillic, this typeface is especially suitable for use in the humanities. For more information, please see [www.brill.nl/brill-typeface](http://www.brill.nl/brill-typeface).

ISSN 1568-1811

ISBN 978 90 04 22918 1 (hardback)

ISBN 978 90 04 22920 4 (e-book)

Copyright 2012 by Koninklijke Brill NV, Leiden, The Netherlands.

Koninklijke Brill NV incorporates the imprints Brill, Global Oriental, Hotei Publishing, IDC Publishers and Martinus Nijhoff Publishers.

All rights reserved. No part of this publication may be reproduced, translated, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission from the publisher.

Authorization to photocopy items for internal or personal use is granted by Koninklijke Brill NV provided that the appropriate fees are paid directly to The Copyright Clearance Center, 222 Rosewood Drive, Suite 910, Danvers, MA 01923, USA.

Fees are subject to change.

This book is printed on acid-free paper.

## CONTENTS

Preface and Acknowledgements .....	ix
Notes on the Editors .....	xi
Notes on the Contributors .....	xiii
List of Illustrations .....	xxi

Introduction .....	1
<i>Helen King</i>	

## PART ONE

### HISTORY OF PHYSIOLOGY IN CONTEXT: CONCEPTS, METAPHORS, ANALOGIES

<i>Physiologia</i> from Galen to Jacob Bording .....	27
<i>Vivian Nutton</i>	

Physiological Analogies and Metaphors In Explanations of the Earth and the Cosmos .....	41
<i>Liba Taub</i>	

The Reception of the Hippocratic Treatise <i>On Glands</i> .....	65
<i>Elizabeth Craik</i>	

Between Atoms and Humours. Lucretius' Didactic Poetry as a Model of Integrated and Bifocal Physiology .....	83
<i>Fabio Tutrone</i>	

Losing Ground. The Disappearance of Attraction from the Kidneys .....	103
<i>Michael R. McVaugh</i>	

The Art of the Distillation of 'Spirits' as a Technological Model for Human Physiology. The Cases of Marsilio Ficino, Joseph Duchesne and Francis Bacon .....	139
<i>Sergius Koderá</i>	

The Body is a Battlefield. Conflict and Control in Seventeenth-Century Physiology and Political Thought .....	171
<i>Sabine Kalf</i>	
Herman Boerhaave's Neurology and the Unchanging Nature of Physiology .....	195
<i>Rina Knoeff</i>	
The Anatomy and Physiology of Mind. David Hume's Vitalistic Account .....	217
<i>Tamás Demeter</i>	
More than a Fading Flame. The Physiology of Old Age between Speculative Analogy and Experimental Method .....	241
<i>Daniel Schäfer</i>	
Suffering Bodies, Sensible Artists. Vitalist Medicine and the Visualising of Corporeal Life in Diderot .....	267
<i>Tomas Macsotay</i>	

## PART TWO

## BLOOD

Blood, Clotting and the Four Humours .....	295
<i>Hans L. Haak</i>	
An Issue of Blood. The Healing of the Woman with the Haemorrhage ( <i>Mark</i> 5.24b–34; <i>Luke</i> 8.42b–48; <i>Matthew</i> 9.19–22) in Early Medieval Visual Culture .....	307
<i>Barbara Baert, Liesbet Kusters and Emma Sidgwick</i>	
The Nature of the Soul and the Passage of Blood through the Lungs. Galen, Ibn al-Nafīs, Servetus, Ītaki, 'Aṭṭār .....	339
<i>Rainer Brömer</i>	
Sperm and Blood, Form and Food. Late Medieval Medical Notions of Male and Female in the Embryology of <i>Membra</i> .....	363
<i>Karine van 't Land</i>	

The Music of the Pulse in Marsilio Ficino's <i>Timaeus</i> Commentary ..... <i>Jacomien Prins</i>	393
'For the Life of a Creature is in the Blood' ( <i>Leviticus</i> 17:11). Some Considerations on Blood as the Source of Life in Sixteenth- Century Religion and Medicine and their Interconnections ..... <i>Catrien Santing</i>	415
White Blood and Red Milk. Analogical Reasoning in Medical Practice and Experimental Physiology (1560–1730) ..... <i>Barbara Orland</i>	443

## PART THREE

## SWEAT AND SKIN

The "Body without Skin" in the Homeric Poems ..... <i>Valeria Gavrylenko</i>	481
Sweat. Learned Concepts and Popular Perceptions, 1500–1800 ..... <i>Michael Stolberg</i>	503
Of the Fisherman's Net and Skin Pores. Reframing Conceptions of the Skin in Medicine 1572–1714 ..... <i>Mieneke te Hennepe</i>	523

## PART FOUR

## TEARS AND SIGHT

Vision and Vision Disorders. Galen's Physiology of Sight ..... <i>Véronique Boudon-Millot</i>	551
Early Modern Medical Thinking on Vision and the Camera Obscura. V.F. Plempius' <i>Ophthalmographia</i> ..... <i>Katrien Vanagt</i>	569



The <i>Tertium Comparationis</i> of the <i>Elementa Physiologiae</i> . –	
Johann Gottfried von Herder's Conception of "Tears" as Mediators between the Sublime and the Actual Bodily Physiology .....	595
<i>Frank W. Stahnisch</i>	

## PART FIVE

## BODY AND SOUL

From Doubt to Certainty. Aspects of the Conceptualisation and Interpretation of Galen's Natural Pneuma .....	629
<i>Julius Rocca</i>	
Metabolisms of the Soul. The Physiology of Bernardino Telesio in Oliva Sabuco's <i>Nueva Filosofía de la Naturaleza del Hombre</i> (1587) .....	661
<i>Marlen Bidwell-Steiner</i>	
"Full of Rapture". Maternal Vocality and Melancholy in Webster's <i>Duchess of Malfi</i> .....	685
<i>Marion A. Wells</i>	
The Sleeping Musician. Aristotle's Vegetative Soul and Ralph Cudworth's Plastic Nature .....	713
<i>Diana Stanciu</i>	
Index Locorum .....	751
Index Generalis .....	760

## PREFACE AND ACKNOWLEDGEMENTS

One of the main questions underlying the colloquium from which this volume derives concerned the many different ways in which we can characterise thinking about the function of the body in the period from the ancient world into early modern Europe. What was meant by 'physiology' before 1800, and how and why did this change? How can different academic disciplines contribute to our understanding of earlier theories of the way the body works? The colloquium was held on 15–18 April 2009 at the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS), Wassenaar, under the aegis of KNAW (the Royal Dutch Academy of Arts and Sciences) and with additional funding from the C.L. Thijssen-Schoute Stichting, the Stichting *Historia Medicinæ*, the *Kunsthistorisches Max Planck Institut* Florence and the Wellcome Trust. We offer our profound thanks to the NIAS staff and especially Mrs Eline van der Ploeg for their friendly and efficient organisation of the conference. Over 50 abstracts were submitted, and 23 papers were selected for presentation.<sup>1</sup> In addition, scholars whose abstracts had not been accepted for presentation were invited by the editors to write papers for consideration. Some of those attending the conference as delegates subsequently submitted papers, while word of mouth brought to the attention of the editors still others interested in contributing.

The contributors to this collection thus come from a wide range of disciplinary approaches, but all aim to contextualise the theories of the function of the body that were proposed in the periods they study. In addition to thanking all our contributors, we would like to put on record

---

<sup>1</sup> The following papers were also selected for presentation, but in the event could not, for a variety of reasons, be included in this volume: Armelle Debru, "Motions and Emotions"; Svetlana Hautala, "The Dull Wave: Meteorological Analogies in the Ancient Medicinal Thought"; Jürgen Helm, "Soul and Spirit in the 16th Century"; Willem van Hoorn, "Descartes' Physiological Misunderstanding of Harvey's Heart"; Manfred Horstmanshoff, "Analogy versus Anatomy: Petrus and Steno on Tears (1661)"; Eric Jorink, "René Descartes (1596–1650), Jan Swammerdam (1637–1680) and the problem of generation"; Christopher Pierce, "Anatomy, Allegory and Architecture: Ideas on the Role of the Church Interior in Seventeenth-Century Netherlandish Art"; Roberto Lo Presti, "'As if bodies were machines': Remarks on the Birth of 'Modern' Physiology and the (Re)invention of the Greek Notion of 'Automaton'"; Georgios Papadopoulos, "Transformations of (the Concepts of) Natural Faculties in Renaissance Physiology"; Marco A. Viniegra, "Galenism and the Rise of Black Bile".

our gratitude to the fifty or so scholars who acted as blind peer reviewers for the submissions, many of these serving as reviewers for more than one paper.

For assistance with translation, the editors would like to thank Neil Allies for his efficient and sensitive work; in addition, for help with particular issues, we would like to thank Peter Kruschwitz, Laura Robson, Daniel Nicolae and Cristina Alvarez-Millàn. This book would not have come to fruition so efficiently without the eye for detail of our editorial assistant, Cornelis van Tilburg who also laid the foundation for the index locorum and the index generalis.

## NOTES ON THE EDITORS

MANFRED (H.F.J.) HORSTMANSHOFF has taught Ancient History at Leiden University since 1976 and was Professor of Ancient Medicine there from 2006–2011. In 1992 he co-organised (with Philip van der Eijk and Piet Schrijvers) the conference “Ancient Medicine in its Socio-Cultural Context” (papers published in 1995, Amsterdam, 2 vols). In 2000–2001 and in 2008–2009 he was Fellow-in-residence at the Netherlands Institute for Advanced Study. He co-ordinated with Marten Stol at NIAS a research group on “Magic and Rationality in Ancient Near Eastern and Graeco-Roman Medicine” (papers published 2004). In 2002 he published (with others) the folio-edition, with full commentary, of Four Anonymous Engravings from the Trent Collection (Duke University, Durham, NC) as *The Four Seasons of Human Life* (2002). He was convenor of the XIIth Colloquium Hippocraticum at Leiden (2005) and editor of its Selected Papers: *Hippocrates and Medical Education* (2010). In 2011–2012 he will be a Fellow of the Internationales Kolleg Morphomata, University of Cologne, studying the patient’s history in a comparative perspective.

HELEN KING is Professor of Classical Studies at the Open University. She works on ancient Greek and Roman medicine and its reception from the sixteenth century onwards, focusing on gynaecology and obstetrics. She has been a Fellow of the Netherlands Institute for Advanced Study, a Craike Lecturer at Mount Allison University, Sackville NB, Canada, a Visiting Professor at the University of Texas and a Landsdowne Visiting Lecturer at the University of Victoria, British Columbia. Her publications include *The Disease of Virgins. Green Sickness, Chlorosis and the Problems of Puberty* (2003); *Midwifery, Obstetrics and the Rise of Gynaecology. Users of a Sixteenth-Century Compendium* (2007) and (with Véronique Dasen), *La médecine dans l'Antiquité grecque et romaine* (2008).

CLAUS ZITTEL teaches philosophy and German literature at the Universities of Frankfurt am Main, Berlin (FU) and Olsztyn (Poland) and is the co-leader of the Max-Planck Research group “The Conscious Image” at the Kunsthistorisches Institut/Max Planck-Institut Florence. He is inter alia the author of *Das ästhetische Kalkül von Friedrich Nietzsches ‘Also sprach Zarathustra’* (2000–2012) and *Theatrum philosophicum. Descartes*

*und die Rolle ästhetischer Formen in der Wissenschaft* (2009), editor of *René Descartes. Les Météores/Die Meteore* (2006); and co-editor (with Sylwia Werner) of *Ludwik Fleck. Denkstile und Tatsachen* (2011); (with Moritz Epple) *Science as Cultural Practice Vol. 1. Cultures and Politics of Research from the Early Modern Period to the Age of Extremes* (2010); (with Gisela Engel and Romano Nanni) *Philosophies of Technology. Francis Bacon and his Contemporaries, "Intersections"* (2008); (with Wolfgang Detel) *Ideals and Cultures of Knowledge in Early Modern Europe* (2002).



## NOTES ON THE CONTRIBUTORS

BARBARA BAERT studied art history and philosophy at the University of Leuven and Università degli Studi of Siena, Italy. Her doctorate on the legend of the Holy Cross, *A Heritage of Holy Wood*, appeared in 2004. She is currently Professor of Medieval Art and Iconology at the University of Leuven. In 2008 she founded the Iconology Research Group, an international and interdisciplinary platform for the study of the interpretation of images. Her publications include *Interspaces between Word, Gaze and Touch. The Bible and the Visual Medium in the Middle Ages. Collected Essays on Noli me tangere, the Woman with the Haemorrhage, the Head of John the Baptist*, Annua Nuntia Lovaniensia, LXII (2011).

MARLEN BIDWELL-STEINER holds an Elise-Richter-grant from the Austrian Science Fund (FWF) to work on her habilitation “Persistent Corporealities: Early Modern Natural Philosophy Meets Postmodern Gender Theory”. She is Head of the Gender Research Office at the University of Vienna. She gained her doctorate in 2007 and works on gender studies, body images, early modern body-soul images, and theories of metaphor. Her publications include (with Stefan Krammer) *(Un)Doing Gender als gelebtes Unterrichtsprinzip. Sprache-Politik-Performanz* (2010) and *Große Welt – Kleine Welt – Verkehrte Welt. Die philogyne Naturphilosophie der Renaissance-Denkerin Oliva Sabuco de Nantes y Barrera* (2009).

VÉRONIQUE BOUDON-MILLOT is Director of the Research Centre on Ancient Medicine at the CNRS (Centre National de la Recherche Scientifique) in Paris at the Sorbonne University. She has published widely on ancient medicine, philosophy and science. She has edited critical editions of six Galenic works. She co-edited *Les Pères de l'Eglise face à la science médicale de leur temps* (2005) and *La science médicale antique. Nouveaux regards* (2007).

RAINER BRÖMER works at the Philosophy Department, Fatih University (Istanbul). His research concerns the history of medicine in the Ottoman Empire, especially human anatomy of the seventeenth to nineteenth centuries. He has published on the history of Darwinism, including Rainer Brömer, Uwe Hoßfeld and Nicolaas Adrianus Rupke, *Evolutionsbiologie*

*von Darwin bis heute* (2000), Uwe Hoßfeld and Rainer Brömer, *Darwinismus und/als Ideologie* (2001) and Rainer Brömer, *Plastidules to Humans. Leopoldo Maggi (1840–1905) and Ernst Haeckel's Naturalist Philosophy in the Kingdom of Italy* (2011).

ELIZABETH CRAIK, formerly Professor of Classics at Kyoto University, held a Leverhulme Emeritus Fellowship 2003–2005 and is now attached to Newcastle University and to the University of St. Andrews. She has edited and translated several Hippocratic texts, with introduction and commentary: *Places in Man* (1998), *Two Hippocratic Treatises. On Sight and On Anatomy* (2006) and *The Hippocratic Treatise On Glands* (2009), as well as publishing extensively on Greek literature and civilisation. Her current project is a book, aiming to cover and contextualise all the treatises of the Hippocratic Corpus.

TAMÁS DEMETER is Senior Research Fellow at the Institute for Philosophical Research, Hungarian Academy of Sciences. He was formerly Lorenz Krüger Fellow at the Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, and he has held Fellowships at the IASH, Edinburgh and the Netherlands Institute for Advanced Study. His research is focused on the philosophy of mind, the history of eighteenth-century philosophy and science, and Austro-Hungarian intellectual history. He is editor of *Essays on Wittgenstein and Austrian Philosophy* (2004) and co-editor (with Kathryn Murphy and Claus Zittel) of the forthcoming “Intersections” volume, *Conflicting Values of Inquiry. The Ideologies of Epistemology in Early Modern Europe*.

VALERIA GAVRYLENKO studied and taught at the Department of Theory and History of Culture at the National University of Kyiv-Mohyla Academy, Kyiv, Ukraine. She works on the history of the human body (with particular focus on skin and touch) in ancient Greek culture. She defended her PhD at the Kharkiv State Academy of Culture in 2007. She has published several articles in Russian, Ukrainian and French on Greek tragedy and on the history of the body in Antiquity.

HANS L. HAAK studied medicine in Leiden, was trained in haematology and obtained his PhD in 1978. He was head of the department of Haematology and consultant in a major hospital in the Hague, and has written over seventy scientific papers. After his retirement he studied classics and history of medicine, on which he has published articles on Rufus of

Ephesus' *Quaestiones Medicinales* and on ancient ideas on vision. He is currently preparing a monograph on Rufus.

MIENEKE TE HENNEPE is curator of medical history at Museum Boerhaave, the National Museum of the History of Science and Medicine in Leiden, the Netherlands. Her PhD thesis *Depicting Skin: Visual Culture in Nineteenth-century Medicine* (2007) was awarded a Research Prize by the Praemium Erasmianum Foundation in 2008. She specialises in visual representation and body history, and her current work concerns early science films and popular representations of female anatomy in flap books.

SABINE KALFF studied German literature, cultural history and American studies at Humboldt University, Berlin and La Sapienza, Rome. Her MA thesis (2006) was on *Monstro Simile. Sovereignty and the Idea of the Body Politic in Early Modern Literature and Political Thought*. She completed her doctoral thesis on *Political Medicine in the Early Modern Period* in 2011. She has held research grants from the German Research Foundation (DFG), 2007–2008, and the Gerda Henkel Foundation, from 2008. She is currently a Research Fellow at the Peter Szondi Institut für Allgemeine und Vergleichende Literaturwissenschaft at the Freie Universität Berlin.

RINA KNOEFF gained her PhD from Cambridge (2000) and is currently a postdoctoral research fellow at the Faculty of Humanities, Leiden University, where she works on a project funded by the Dutch Research Council (NWO) on the history of the Leiden anatomical collections. She is particularly interested in the collections from the visitors' point of view. She has written numerous articles on early modern medicine and she is the author of *Herman Boerhaave (1668–1738). Calvinist Chemist and Physician* (2002).

SERGIUS KODERA teaches philosophy at the University of Vienna. He has published on Marsilio Ficino, Fernando de Rojas, Leone Ebreo, Matteo Ricci, Girolamo Cardano, Giambattista della Porta, and Giordano Bruno. His last monograph is on *Disreputable Bodies. Magic, Medicine, and Gender in Renaissance Natural Philosophy* (2010).

LIESBET KUSTERS holds a Master's degree in Art History (2004). Currently she is involved in a PhD project entitled *The Haemorrhaging Woman (Mark 5:24–34). An Iconological Research into the Meaning of the Bleeding Woman in Medieval Art (4th–15th century)* supervised by Barbara Baert. In

addition she teaches art history of the Middle Ages at the Royal Academy for Fine Arts (KASK) in Ghent.

KARINE VAN 'T LAND is preparing a dissertation about nutrition and identity in late medieval commentaries on Avicenna's *Canon* at Radboud University Nijmegen, Netherlands. Together with Patricia Baker and Han Nijdam, she edited the volume *Medicine and Space. Body, Surroundings and Borders in Antiquity and the Middle Ages* (Leiden: 2011).

TOMAS MACSOTAY is a Henry Moore Foundation Fellow in Sculpture Studies at Leeds. His dissertation was awarded the Prix Marianne Roland-Michel, marking outstanding studies in eighteenth-century French art. He is currently preparing a book on the basis of his dissertation on eighteenth-century French sculptors and the Académie royale de peinture et de sculpture. His research interests include the definition and function of eighteenth-century sculpture across national barriers, theories of making and their impact on the cultural history of the workshop between the eighteenth and nineteenth centuries.

MICHAEL MCVAUGH is Wells Professor of History Emeritus at the University of North Carolina, Chapel Hill. He has published widely on thirteenth- and fourteenth-century medicine, including *Medicine before the Plague. Practitioners and their Patients in the Crown of Aragon, 1285–1345* (1993), which was awarded the Welch Medal of the American Association for the History of Medicine in 1994, and *The Rational Surgery of the Middle Ages* (2006). He has been one of the general editors of the *Arnaldi de Villanova Opera Medica Omnia* since 1975, and is currently working on two editions for inclusion in that series. Since 2008, he has also been publishing the medieval Latin translations of Maimonides' medical works in the collection of Arabic and Hebrew texts now being edited by Gerrit Bos. He was awarded the Sarton Medal of the History of Science Society in 2010.

VIVIAN NUTTON is a former Director of the Wellcome Trust Centre, London – formerly the Wellcome Institute for the History of Medicine – where he taught from 1977, and a Fellow of the British Academy. He specialises in the history of the classical tradition in medicine, from Antiquity to the present, and particularly on Galen, and on medicine during the Renaissance. A prolific writer, editor and translator, his publications include the first ever edition and translation of Galen's *On My Own*

*Opinions* (1999) an edited issue of *Renaissance Studies*, *Medicine in the Renaissance City* (2001), and *Ancient Medicine* (2004).

BARBARA ORLAND is a senior scientist at the Science Studies Program, University of Basel (Switzerland). From 2004–2007 she was the managing director of the newly founded Centre History of Knowledge at the Federal Institute of Technology and the University of Zurich. She has been the Käthe-Leichter guest professor at the University of Vienna (2007–2008) and is currently acting Professor of the History of Science at the University of Konstanz. Her research interests cover different fields of the history of life sciences and biomedical technologies. She is the author of *Eine Geschichte der Ernährungstheorien. Vom antiken zum modernen Wissen* (forthcoming, 2012) and the editor, with Emma C. Spary, of *Assimilating Knowledge. Food and Nutrition in Early Modern Physiologies*, Special Issue of *Studies in History and Philosophy of the Sciences* 1 (2012) forthcoming.

JACOMIEN PRINS is based at the Department of Philosophy of Oxford University and is a Fellow of Wolfson College. Her current research focuses on the reception of ideas about cosmic harmony in Plato's *Timaeus* during the Italian Renaissance. Her publications include *Echoes of an Invisible World. Marsilio Ficino and Francesco Patrizi on Cosmic Order and Music Theory* (2009 and 2011) and she edited the Dutch volume *Harmonisch labyrint. De muziek van de kosmos in de westerse wereld (Harmonious Labyrinth)* (2007) and she has published several articles on the philosophy of music.

JULIUS ROCCA holds a Wellcome Trust Award at the Department of Classics and Ancient History, University of Exeter. He is the author of *Galen on the Brain* (2003), articles on ancient medicine and philosophy, and is writing a monograph on Galen's teleology. He is preparing a volume of essays based on the Exeter 2009 Wellcome Trust funded conference "Teleology in Ancient Philosophy and Medicine", to be submitted to Cambridge University Press.

CATRIEN SANTING is the Professor of Medieval History at the University of Groningen. She studied history and art history at the University of Groningen, then worked for the Dutch Institute in Rome from 1998 until 2003. A cultural historian of the Late Middle Ages and Renaissance, she focuses on the history of medicine and the body in the Late Middle Ages. A former Fellow of the Netherlands Institute for Advanced Studies, she has published widely on northern Humanism, visual culture, medievalism and



the interchange between art and science. She has edited (together with Flos Wilschut), *Ophelia, melancholie en sehnsucht. Tentoonstellingscatalogus Museum voor de Moderne Kunst Arnhem* (2009) and (together with Jetze Touber) *Blood Symbol Liquid* (2011).

DANIEL SCHÄFER studied medicine and medieval studies at Albert-Ludwigs-Universität Freiburg and gained his doctorates from this university. He works at the Institute of History and Ethics of Medicine at the University of Cologne, where he was promoted to extraordinary Professor in 2007. In April 2009 his revised thesis won a Fritz Thyssen Foundation prize. His main interests are the history of ageing, gynaecology, preventative medicine, and death. His publications include *Old Age and Disease in Early Modern Medicine* (2011) and (with Héctor Wittwer and Andreas Frewer) *Dying and Death. An Interdisciplinary Manual. History, Theory, Ethics* (2010).

EMMA SIDGWICK holds a Master's degree in Fine Arts and in Social and Cultural Anthropology. Together with Liesbet Kusters she is involved in a PhD project entitled *The Haemorrhaging Woman (Mark 5:24–34). An Iconological Research into the Meaning of the Bleeding Woman in Medieval Art (4th–15th century)* supervised by Barbara Baert.

FRANK W. STAHNISCH holds the AMF/Hannah Professorship in the History of Medicine and Health Care at the University of Calgary in Alberta, Canada, and is cross-appointed to the Department of History and the Department of Community Health Sciences. He is also a full academic member of the Hotchkiss Brain Institute and the Calgary Institute for Population and Public Health. His research comprises the history of experimental physiology, the relationship between the neurosciences and the philosophy of mind, the historical epistemology of the life sciences, and the history of visualisation practices in medicine. Publications include *Ideas in Action* (2003), (co-edited with Florian Steger) *Medizin, Geschichte und Geschlecht* (2005), and (co-edited with Ulrich Schoenherr and Antonio Bergua) *Albert Neissers 'Stereoscopischer Medicinischer Atlas'* (2006), (co-edited with Heijko Bauer) *Bild und Gestalt* (2007). His current book project focuses on the development of interdisciplinary research traditions of the brain sciences in relation to their cultural context.

DIANA STANCIU is currently a postdoctoral fellow in the Faculty of Theology, The Catholic University of Leuven, researching the reception of Augustine versus that of Aristotle in seventeenth-century Louvain. She was formerly an associate professor at the University of Bucharest. Her research interests include grace and free will, rational religion, freedom of conscience, toleration and prudence. Her publications include: *Shaftesbury's 'Characteristics' – A 'Socratic' Programme of the Eighteenth Century* (PhD thesis; 2004); *The Ninth-century Debate on Predestination and its Theologico-Political Context* (2005); (co-edited with Heinrich Kuhn) *Ideal Constitutions in the Renaissance* (2009), and *The Reception of Aristotle in the Augustinian Context of Seventeenth-century Louvain* (forthcoming 2012).

MICHAEL STOLBERG is Professor of History of Medicine and Director of the Institut für Geschichte der Medizin at the University of Würzburg. His major areas of research are the social and cultural history of early modern medicine and the history of medical ethics and terminal care. His publications include *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (2003), *Die Harnschau. Eine Kultur- und Alltagsgeschichte* (2009) and *Die Geschichte der Palliativmedizin. Medizinische Sterbebegleitung von 1500 bis heute* (2011).

LIBA TAUB is Professor of History and Philosophy of Science and Director and Curator of the Whipple Museum of the History of Science, at the University of Cambridge; she is a Fellow of Newnham College. Her primary research interests are in the areas of Greco-Roman science and the material culture of science. She is the author of *Ptolemy's Universe. The Natural Philosophical and Ethical Foundations of Ptolemy's Astronomy* (1993), *Ancient Meteorology* (2003), and *Aetna and the Moon. Explaining Nature in Ancient Greece and Rome* (2008). She has co-edited (with Aude Doody) *Authorial Voices in Greco-Roman Technical Writing* (2009) and (with Frances Willmoth) *The Whipple Museum of the History of Science. Instruments and Interpretations* (2006).

FABIO TUTRONE is a Research Fellow at the University of Palermo (Italy), where he also obtained his PhD in Greek and Latin Philology and Culture in 2009. In 2008 he was Visiting Scholar at the Department of Classics at Columbia University in the City of New York and in 2009 he was awarded a research scholarship at the Fondation Hardt pour l'Étude de l'Antiquité Classique (Geneva). He works on different themes related to ancient literature, science and philosophy, but in particular on animal representations and man-animal relationships in Roman culture.

KATRIEN VANAGT received her doctorate from the University of Twente in 2010, for a thesis entitled *The Emancipation of the Eye. V.F. Plempius' Ophthalmographia and Medical Conceptions of Sight*. She has recently been awarded a two-year Rubicon Postdoctoral Fellowship by the Netherlands Organisation for Scientific Research (NWO) to pursue her research at the Huygens Institute ING in The Hague. In investigating early modern theories of vision, Vanagt seeks to understand how knowledge is transmitted between groups of people who use different disciplinary discourses, the process of appropriation which this entails, and the generation of new interpretations and meanings.

MARION A. WELLS teaches in the Department of English and American Literatures at Middlebury College, USA. She has a BA in Classics and Modern Languages from Jesus College, Oxford, and a PhD in Comparative Literature from Yale University. Her book *The Secret Wound. Love-Melancholy and Early Modern Romance* was published by Stanford University Press in 2007. Current research interests include the epithalamic tradition from Virgil to Ariosto, ekphrasis, and expressions of maternal grief in early modern Europe. She is currently working on a new book manuscript tentatively entitled *Philomela's Song. Maternal Voice in Early Modern Europe*.

## LIST OF ILLUSTRATIONS

### *Figures 1–2 (belonging to the Introduction by Helen King):*

1. Francis Bacon, *The Historie of Life and Death* (London, Humphrey Mosley: 1638), title page. Engraving. © Trustees of the British Museum ..... 12
2. Philippi Jacobi Sachs a Lewenheimb, *Oceanus Macro-Microcosmicus* (Wroclaw, Fellgiebel: 1664). Frontispiece ..... 14

### *Figures 1–2 (belonging to the article by Michael R. McVaugh):*

1. Human kidney. Drawing Lauren Keswick © 2011 www.medicalartstudio.com ..... 104
2. Hollow kidney divided into two halves, in Andreas Vesalius, *De humani corporis fabrica* V.10 (Basel, Oporinus: 1543; repr. Nieuwendijk, De Forel: 1975) 515 ..... 114

### *Figures 1–5 (belonging to the article by Daniel Schäfer):*

1. Cover of Gabriele Zerbi's *Gerontocomia* (Rome, Eucharius Silber: 1489) ..... 251
2. Diagram of the physiology and pathology of age and ageing, in François de Fougerolles, *De senum affectibus praecavendis nonnullisque curandis enarratio* (Lyons, Ian. de Gabiano and Laur. Durand: 1617) 53 ..... 254
3. Title page of the reprint of Jacob Hutter's dissertation/thesis (Halle, Christian Hilliger: 1732) ..... 258
4. Bills of Mortality, London 1666 (from <http://www.slought.org/content/410265/>) ..... 261
5. Cornelis Huijberts, engraving of a so-called 'diorama': Foetus with vascular preparations etc., C. Huijberts ad vivum sculpsit, in Frederik Ruysch, *Thesaurus anatomicus octavus. Het achtste anatomisch cabinet van Frederic Ruysch* (Amsterdam, Joannes Wolters: 1709) ..... 263

*Figures 1–2 (belonging to the article by Tomas Macsotay):*

1. *Laocoön*, copied from the original (ca. 200 BC) by the three Rhodian sculptors Agesander, Athenodorus and Polydorus. Marble, height 184 cm. Rome, Vatican, Museo Pio-Clementino ..... 276
2. Etienne Maurice Falconet, *Milo of Crotona*. 1754. Marble, height 66 cm, width 64 cm. Paris, Louvre ..... 282

*Figures 1–12 (belonging to the article by Barbara Baert et al.):*

1. *Healing of the Haemorrhissa*, mural in the catacomb of Saints Peter and Marcellinus, third century. Rome ..... 315
2. *Healing of the Haemorrhissa*, detail of the *Brescia Casket*, ca. 360–370. Ivory relief. Brescia, Museo Civico ..... 317
3. *Healing of the Haemorrhissa*, detail of the *Sarcophagus of Adelpheia and Syrakus*. Rome, ca. 340. Syracuse (Sicily), Museo Nazionale ..... 318
4. *Healing of the Haemorrhissa*, detail of a sarcophagus, fifth century. Istanbul, Archaeological Museum ..... 319
5. *Healing of the Haemorrhissa*, miniature in the *Codex Egberti* (Reichenau, 977–993). Trier, Stadtbibliothek (ms. 24, f. 90 verso) ..... 320
6. *Healings and Miracles of Christ, Encolpion from Adana*, end of the sixth century ..... 322
7. *Healing of the Haemorrhissa and Peter turning the prison wall into water, Celsus sarcophagus*, fourth century. Milan, S. Maria presso S. Celso ..... 323
8. *Resurrection of Lazarus and Healing of the Haemorrhissa*, fifth century. Coptic textile. London, Victoria and Albert Museum (inv. no. 722–1897) ..... 326
9. *Healings and Miracles of Christ*, early Byzantine amulet. London, British Museum (reg. no. 1938) ..... 327
10. *Healing of the Haemorrhissa*, crystal amulet. Rock crystal, 30 × 20 × 4 cm. New York, America Numismatic Society (inv. no 307) ..... 329
11. *Healing of the Haemorrhissa and Mary in Orant*, haematite amulet. Egypt, late Antiquity. New York, Metropolitan Museum of Art (17.190.491) ..... 330

12. *Healing of the Haemorrhoid and hysteria motif, amulet.*  
Private collection ..... 331

*Figures 1–4 (belonging to the article by Rainer Brömer):*

1. Skeleton, from Andreas Vesalius' *De humani corporis fabrica libri septem* (Basel, Oporinus: 1543) 164. Image © National Library of Medicine [Vesalius\_Pg\_164.jpg, [http://www.nlm.nih.gov/exhibition/historicalanatomies/Images/1200\\_pixels/Vesalius\\_Pg\\_164.jpg](http://www.nlm.nih.gov/exhibition/historicalanatomies/Images/1200_pixels/Vesalius_Pg_164.jpg)] ..... 352
2. Skeleton, from Şemsettin İtâki, *Teşrîh-i Ebdân ve Tercümân Kibâle-ı Fezlesûfân* (Hüsrev Paşa 464 fol. 31). Image © Süleymaniyye Kütüphanesi, Istanbul, Turkey [HUSREV PASA 464-\_00031.jpg] ..... 353
3. Venous system from Manşûr ibn İlyâs, *Tashrîh-i badan-i insan*, (Ayasofya 3597 fol 25b). Image © Süleymaniyye Kütüphanesi, Istanbul, Turkey [AYASOFYA 3597-\_00028.jpg] ..... 354
4. Venous system from Şemsettin İtâki's *Teşrîh-i Ebdân ve Tercümân Kibâle-ı Feylesûfân* (Hüsrev Paşa 464 fol. 84b). Image © Süleymaniyye Kütüphanesi, Istanbul, Turkey [HUSREV PASA 464-\_00085.jpg] ..... 355

*Figures 1–3 (belonging to the article by Jacomien Prins):*

1. Physician taking the pulse of a plague victim. Frontispiece from Ioannis de Ketham's *Fasciculo di Medicina Vulgare* (*Fasciculus medicine compositus per [...] dominum Ioannem de Ketham* (Venice, I. et G. de Gregoriis: 1495). Oxford, Bodleian Library (AA 21(1) Med.Seld) ..... 397
2. Threefold man, from Robert Fludd, *Utriusque cosmi maioris scilicet et minoris metaphysica, physica atque technica historia in duo volumina secundum cosmi differentiam divisa* (Oppenheim, Johann-Theodor de Bry, Hieronymus Galler: 1617/1621), vol. II.a.1, p. 105. Copper engraving. Oxford, Bodleian Library (Ashm. 1704 v.2:pt.1–v.2:pt.2) ..... 401
3. Diagram. Blood circulation and the sense of hearing following the same archetypal laws of circular thrust. Basis design: *Plato's Cosmology. The Timaeus of Plato*, tr./comm. F. MacDonald Cornford (London-New York: 1937) 313 (with additions and revisions by J. Prins) ..... 409

*Figures 1–4 (belonging to the article by Catrien Santing):*

1. Jacob van Oostsanen, <i>Man of Sorrows</i> , ca. 1520. Antwerp, Museum Mayer van den Bergh .....	421
2. Titlepage of the English translation of Lemnius' <i>De habitu et constitutione corporis</i> , tr. Newton Thomas (London, Thomas Marsh: 1576). Amsterdam, Universiteitsbibliotheek (UvA), bijzondere collecties (OTM: OK 74–181) .....	425
3. Maarten van Heemskerck, <i>Christ crowned with thorns</i> , ca. 1550/1555. Haarlem, Frans Hals Museum .....	430
4. Beginning of the first book of Andrea Cesalpino's handbook <i>Ars Medica</i> with an image of the Vera Icon in the margin. Amsterdam, Universiteitsbibliotheek (UvA), bijzondere collecties (OTM: O 62–9143) .....	436

*Figures 1–10 (belonging to the article by Mienieke M. G. te Hennepe):*

1. Gasparo Becerra, "Standing male écorché", in Juan Valverde de Hamusco, <i>Historia de la Composición del Cuerpo Humano</i> (Rome, Salamanca and Lafreri: 1556), Book II, Tabula I. Copper engraving. Image © Wellcome Library, London .....	530
2. Gerard de Lairese, "Microscopical anatomy of the skin" in William Cowper's <i>The Anatomy of Humane Bodies</i> (Oxford, S. Smith and B. Walford: 1698), Tabula 4. Copper engraving. Image © Wellcome Library, London .....	533
3. Porous appearance of cork viewed under a microscope, in Robert Hooke, <i>Micrographia</i> (London, J. Martyn & Allestry: 1665) Scheme IX, Fig. 1. Engraved illustration. Image © Wellcome Library, London .....	535
4. Pores of the skin of the hands positioned on ridges as depicted by Nehemiah Grew, in <i>Philosophical Transactions</i> Volume 14 (1684) 566. Engraving illustration. Image © Wellcome Library, London .....	537
5. Simple microscope made and used by Antoni van Leeuwenhoek. Leiden, Museum Boerhaave, V7017. Photo © Museum Boerhaave, Leiden .....	539
6. Scales of the skin resembling 'fish scales' as depicted by van Leeuwenhoek published as illustration in <i>Philosophical Transactions</i> 14 (1684). Leiden, Universiteitsbibliotheek (560 B 8–E 8). Image © University Library Leiden .....	540

7. Jonas Dryander, Vapour baths apparatus. Frankfurt, 1547. Wood engraving. Image © Wellcome Library, London .....	542
8. J. Harrewijn, Sweat treatment to cure syphilis in Steven Blankaart, <i>Venus belegert en ontset. Oft Verhandelinge van de pokken, en des selfs toevallen, met een grondige en zekere genesinge. Steunende meest op de gronden van Cartesius</i> (Amsterdam, Timotheus ten Hoorn: 1684), Tab. VI. Copper engraving. Image © Wellcome Library, London .....	543
9. Scales of the skin reappear in a popular work on microscopy, in Henry Baker <i>The Microscope Made Easy</i> (London, R. Dodsley: 1744), plate XIII, Fig.III. Copper engraving. Image © Wellcome Library, London .....	545
10. Microscopical representation of the skin in a popular hygiene work, in E. Wilson, <i>Healthy Skin. A Popular Treatise on the Skin and Hair, their Preservation and Management</i> (London: 1953) Fourth edition, Fig. 10, page 24. Wood engraving. Image © Wellcome Library, London .....	547

*Figures 1–2 (belonging to the article by Katrien Vanagt):*

1. Comparison between the working of an eye and a camera obscura in Christoph Scheiner, <i>Rosa Ursina</i> (Bracciano, Andreas Phaeus: 1630) 109, 'Artis et Naturae Tubi et Oculi in speciebus solaribus praesentandis consensus'. Leiden, Universiteitsbibliotheek (676 A 24) .....	586
2. Illustration of the dissection-experiment in René Descartes, <i>Discours de la Méthode</i> (Leiden, Jan Maire: 1637) 36. Leiden, Universiteitsbibliotheek (20643 F 8) .....	589

*Figures 1–3 (belonging to the article by Frank W. Stahnisch):*

1. Johann Gottfried von Herder, <i>Certificate from the Society for Natural History and Science</i> , 1793 (Capsule XXXVII, No. 134; AHN; of the Manuscript and Incunables Collection of the Berlin State Library; Culture Forum). Scan Reproduction © Berliner Staatsbibliothek .....	601
2. Friedrich Rehberg, <i>Johann Gottfried von Herder</i> , before 1800. Archival records of Johann Gottfried Herder, Goethe and Schiller Archive. Oil portrait on canvas. Image © Klassik Stiftung Weimar .....	604



3. Johann Gottfried von Herder, *Table of Notes on Physiology, Psychology and Anthropology*, ca. 1765 (Capsule XXVIII, No. 2; AHN; of the Manuscript and Incunables Collection of the Berlin State Library; Culture Forum). Scan Reproduction © Berliner Staatsbibliothek ..... 612

## INTRODUCTION

Helen King

### *Writing physiology*

In the history of early modern medicine, physiology – now understood as the theory of the normal functioning of living organisms – remains the poor relation.

The papers presented here are intended to help scholars in a range of disciplines to consider why it is so difficult to provide a history of physiology; how far is this due to changing notions of what physiology is, and how far does it depend on the methods by which physiology comes to its conclusions? There has been no general history of physiology for the last forty years and, in contrast to anatomy, the topic has received very little attention at all from historians in that period. Within philosophy, the situation is rather different; the work of Dennis Des Chene, particularly his *Physiologia. Natural Philosophy in Late Aristotelian and Cartesian Philosophy* (Cornell University Press, 1996) has been welcomed by philosophers but has had surprisingly little impact outside that field. In this book, and in his subsequent monograph *Life's Form. Late Aristotelian Conceptions of the Soul* (2000), Des Chene locates Descartes within his Aristotelian background, exploring the emergence of modern ideas of 'science' from medieval philosophy. The standard modern histories of physiology include Thomas Hall's work, originally published in 1969 and subsequently reissued as *History of Physiology 200 BC–AD 1900* in 1975, and the 1953 book in German by Karl Rothschuh, published in English translation in 1973.<sup>1</sup> Hall set out what he regarded as the 'classic questions' of physiology, from the Greeks onwards: these concerned 'motion, generation, nutrition' and 'the life-matter problem, of the nature of life and of its seat in the body'.<sup>2</sup> In his Introduction to the English translation of Rothschuh, Leonard G. Wilson stated that 'Physiology, as a subject of inquiry has a long and remarkably

---

<sup>1</sup> Hall T., *History of Physiology 200 BC to AD 1900* (Chicago: 1975); Rothschuh K., *History of Physiology*, tr. Risse G. (Huntington, NY: 1973).

<sup>2</sup> Hall, *History of Physiology* 7.

continuous history beginning with studies and speculations of the Greeks in the fifth century BC.<sup>3</sup>

This image of continuity has been challenged by the work of Andrew Cunningham, whose papers published in 2002 and 2003 respectively, cited by a number of contributors to this volume, are among the very few modern studies of the relationship between anatomy and physiology in the Early Modern period. Cunningham emphasised how physiology used reason rather than experiment, and that it remained very close to philosophy, so that 'When explanations in natural philosophy changed, so explanation in physiology also changed'.<sup>4</sup> While the word 'physiology' is thus found in texts written before the nineteenth century, there is a wide range of concepts working underneath the same name.

In contrast to the neglect of the unified and functioning body of 'physiology', the history of 'anatomy' – traditionally seen as concerned with structure, rather than function – has been the subject of considerable recent study. Trends in medical history towards 'the body in parts' approach have privileged anatomy; literally, the cutting-up or 'division' of the body. They have done this by concentrating on a single body part – heart, head, foot – and tracing its representation and interpretation across time.<sup>5</sup> Anatomy has been important in recent histories of early modern medicine partly because of its place in education; for example, Katy Park's *Secrets of Women* (2006) traced the rise of human dissection from its emergence in the thirteenth century to its establishment in the curriculum of European universities in the mid-sixteenth century, and showed how the quest to understand women's

---

<sup>3</sup> Rothsschuh, *History of Physiology* xi. On the claims for continuity, see further Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 636.

<sup>4</sup> Cunningham, "Old Physiology – The Pen" 641. The companion article is "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.

<sup>5</sup> King H., "Inside and Outside, Cavities and Containers: the Organs of Generation in Seventeenth-century English Medicine" in Baker P. – Land-van Wesenbeeck K. van 't (eds.), *Medicine and Space. Body, Surroundings, and Borders in Antiquity and the Middle Ages* (Leiden: 2011) 37–60. See for example Hillman D. – Mazzi C. (eds.), *The Body in Parts. Fantasies of Corporeality in Early Modern Europe* (London-New York: 1997); Porter J. (ed.), *Constructions of the Classical Body* (Ann Arbor, MI: 1999); Egmond F. – Zwijnenberg R. (eds.), *Bodily Extremities. Preoccupations with the Human Body in Early Modern European Culture* (Aldershot: 2003). See also Cunningham, "Old Anatomy – The Sword" 57 'anatomists were, in general, more concerned with the parts than with the whole body, which was the subject-matter of the old physiologist'.

interior ‘secrets’ informed this anatomical turn to medicine.<sup>6</sup> The division of the body was, she has shown, an important part of early modern cultural practices even before the rise of dissection for educational purposes; parts of the dead, saintly body could be buried separately, and preserved independently as relics.<sup>7</sup> Furthermore, the demonstrations in the anatomy theatres of sixteenth-century Europe were less about anatomical training and more about moral education, with the audiences including civic dignitaries and interested men of learning.<sup>8</sup>

What Cunningham characterises as ‘old physiology’ – in order to distinguish it from the ‘experimental physiology’ of the nineteenth century – emerged as a ‘sub-discipline of the experimental discipline of anatomy’ in the eighteenth century, and was seen as a speculative activity in which the scientist took the facts of anatomy as the basis of his speculations.<sup>9</sup> In the eighteenth century, physiology was close to physics, since it depended on notions of the nature of matter and of motion. Albrecht von Haller recognised that it was necessary to become an expert anatomist before becoming a physiologist and described physiology as ‘animated anatomy’.<sup>10</sup> William Hunter wrote in his *Two Introductory Lectures [...] to his Last Course of Anatomical Lectures* that ‘every good Anatomist, who has a cool head, and keeps a guard over his imagination, knows, that many of the received hypotheses in Physiology, are build on very loose foundations, and liable to weighty objections; or, demonstrably repugnant to what we already know of the structure of our body’.<sup>11</sup>

But what of the period before the eighteenth century, on which this collection of essays focuses? What was physiology, before it became the speculative wing of anatomy? Tilly Tansey’s chapter on ‘The physiological tradition’ in Bynum and Porter’s *Companion Encyclopedia of the History of*

---

<sup>6</sup> Park K., *Secrets of Women. Gender, Generation and the Origins of Human Dissection* (Brooklyn, NY: 2006); Cunningham, “Old Anatomy – The Sword” 52.

<sup>7</sup> See Cunningham A., *The Anatomical Renaissance. The Revival of the Anatomy Projects of the Ancients* (Aldershot: 1997); Santing C., *The Heart of the Matter. Signification and Iconic Reification of Human Remains at the Papal Court, ca. 1450–1600* (forthcoming).

<sup>8</sup> Huisman T., *The Finger of God. Anatomical Practice in 17th-century Leiden* (Leiden: 2009).

<sup>9</sup> Cunningham A., *The Anatomist Anatomis’d. An Experimental Discipline in Enlightenment Europe* (Aldershot: 2010) 156–157.

<sup>10</sup> Cunningham, *The Anatomist Anatomis’d* 93 and 157. On von Haller, see further Cunningham, “Old Physiology – The Pen” 650–657.

<sup>11</sup> Hunter William, *Two Introductory Lectures, Delivered by Dr William Hunter, to his Last Course of Anatomical Lectures* (London, printed by order of the Trustees, for J. Johnson: 1784) 93–94; cited in Cunningham, *The Anatomist Anatomis’d* 138–139.

*Medicine* (1993) contained only two pages on ‘the Renaissance’, one of them being devoted to William Harvey.<sup>12</sup> One of the roles of the present volume is to try to flesh out the period before Harvey. Anatomy claimed as its founder the great hero of classical medicine, the second-century AD writer Galen whose ideas, systematised into ‘Galenism’, dominated medicine into the Early Modern period. Galen himself had not been able to perform systematic human dissection, but his work on animals led him to stress the importance of understanding the structure in order to comprehend the function. Thus those sixteenth-century writers who argued that the true study of the physician or surgeon should be the ‘book’ of the human body itself could still call on Galen for support; if only he had been allowed by the conventions of his day to perform dissection, he would have done exactly as they were now able to do. Hence Cunningham, memorably, described the great Renaissance anatomist Andreas Vesalius as ‘simply Galen restored to life’.<sup>13</sup>

At the peak of the practice of ‘anatomy’ in early modern Europe there was also a move towards seeing medicine itself as unduly ‘divided’ by changes in its professional and intellectual structure between the ancient world and the Renaissance. In the *Preface* to *De corporis humani fabrica* (1543) Vesalius produced a polemic against the perceived inadequacies of the medicine of his own day. In this text on the fragmentation of the body, the great evil is another sort of ‘fragmentation’: ‘that evil fragmentation of the healing art’. ‘So much did the ancient art of medicine decline many years ago from its former glory’: Vesalius regards the lost ideal as being the Alexandrian medicine of the third century BC, which he saw as bringing together control of diet, drugs and surgery in a single person, in contrast to the medicine of his own day when nurses supervise diet, apothecaries drugs, and barbers all manual operations. In Vesalius himself – according to Vesalius – the three spheres had been reunited; this supposed ideal of classical Greek medicine had been realised afresh. Was physiology part of the role of this ideal, holistic, physician?

But, as Vivian Nutton shows in the essay which opens this collection, while Galen wrote a great deal about anatomy, he was less enthusiastic about the role of ‘physiologising’ in medicine. Lending another dimension to the point that the modern division between anatomy and physiology is itself a historical construct, for Galen, the term physiology extended well beyond

---

<sup>12</sup> Tansey E.M., “The Physiological Tradition” in Walker Bynum C. – Porter R. (eds.), *Companion Encyclopedia of the History of Medicine* (London: 1993), vol. 1. On Harvey as ‘no physiologist but an anatomist’, see Cunningham, “Old Anatomy – The Sword” 55.

<sup>13</sup> Cunningham, *Anatomical Renaissance* 115.

later concepts of the normal functioning of an organism and even included far more than those areas which we would label the life sciences and medicine. Deriving from the Greek *phusiologia*, in the ancient world physiology formed part of what is better translated as ‘the enquiry into nature’ rather than as ‘natural history’, and represented a search for a better understanding of the power of nature and of what is ‘natural’ and ‘contrary to nature’. In medicine, Galen believed, these types of speculation should hold only a minor place.

In its original meaning, then, *phusiologia* was the entire tree, rather than only one branch. As a predecessor of Galen wrote, ‘The physiological is that which treats of the investigation, *theôria*, into the power of nature that organises and regulates us’.<sup>14</sup> As for the modern sense of ‘physiology’, which is commonly traced back to Jean Fernel, this concept can be traced back to the fifth century AD; furthermore, Fernel too included anatomy under the heading of physiology.<sup>15</sup> Nutton argues that Fernel used the term ‘physiology’ in order to emphasise his Greek credentials, and that it was only in the second half of the nineteenth century that physiology came to be seen as separate from anatomy.

The discourse of medical paternity sometimes makes Fernel ‘the Father of Physiology’, but – in comparison with anatomy – the situation is again less clear. While Herophilus is labelled ‘the Father of Anatomy’ – Vesalius sometimes rivals him, but as ‘Father of Modern Anatomy’ – who holds the corresponding role for physiology? Sometimes it is Herophilus’s fellow physician Erasistratus, but this in fact imposes on to these two men a later division, projecting back distinctions that were not made in their period, the third century BC. Other contenders for ‘the Father of Physiology’ include Herman Boerhaave, William Harvey, and the nineteenth-century William Sharpey or Claude Bernard, for whom – reversing the priority order of the previous century – ‘Anatomy is indeed only the first step in physiology’.<sup>16</sup>

### *The movement of fluids*

It has become a commonplace that the pre-modern body was ‘a body of fluids’ rather than a ‘body of organs’, but study of these fluids has thus

<sup>14</sup> Galenus, *Definitiones medicae* 11 (19.351 K.); see below, V. Nutton 29 in this volume.

<sup>15</sup> On Fernel, see Cunningham, “Old Physiology – The Pen” 641–648.

<sup>16</sup> Cunningham, “Old Physiology – The Pen” 639.

far tended to concentrate on the humours.<sup>17</sup> The colloquium as originally conceived aimed to expand the boundaries and to include studies of non-humoral fluids such as sweat, semen, urine and tears, as well as more individual concepts such as the medieval theories of two types of female seed (discussed here by Karine van 't Land), Boerhaave's 'nervous juice' or Sabuco's *chilo*, studied in Marlen Bidwell-Steiner's contribution to this volume.

Specifically, when Manfred Horstmanshoff and Helen King began to draft the original Call for Papers, Horstmanshoff was beginning a project on tears, focusing in particular on the French physician Pierre Petit (Petrus Petitus, 1617–1687). Pliny the Elder had claimed the capacity to shed tears as something that defined human beings against other animals, stating that 'Man alone Nature deposits naked on the naked ground at the time of his birth, immediately to wail and cry' (*Natural History* 7.2).<sup>18</sup> Horstmanshoff noted that the classically-rooted work of Petit, *De lacrymis libri tres* (1661), was published in the same year as the Danish anatomist, geologist, mathematician, theologian, and craftsman Niels Stensen (Nicolaus Stenonius) defended at the University of Leiden his thesis on the glands of the human face.<sup>19</sup> While the thesis did not discuss the lachrymal glands, in December of the same year Stensen published *De glandulis oculorum novisque earundem vasis observationes anatomicae, quibus veri lacrymarum fontes deteguntur*. It was then printed again, with the 1661 dating, within a more accessible book: *Observationes anatomicae* (1662). Horstmanshoff was struck by the synchronicity of the 1661 events. The same year saw a thoroughly 'classical' discussion of questions such as how tears are produced and 'Whether the substance of tears is already in the body before weeping, or comes into existence by weeping itself', structured in Aristotelian terms, drawing on Greek and Latin sources as well as

---

<sup>17</sup> Cunningham, *The Anatomist Anatomis'd* 158 cites Winslow's 1733 comment that 'The history of the fluid parts [...] properly belongs to what is called Physiology or the Animal Oeconomy'.

<sup>18</sup> '<Natura> hominem tantum nudum et in nuda humo natali die abicit ad vagitus statim et ploratum'.

<sup>19</sup> Stensen's thesis: *Disputatio anatomica de glandulis oris, et nuper observatis inde prodeuntibus vasis prima*, Leiden, Johannes Elzevir: 1661. *De glandulis oculorum novisque earundem vasis observationes anatomicae, quibus veri lacrymarum fontes deteguntur* is printed from 79 in his *Observationes anatomicae*, Leiden, Jacobus Chouët: 1662. There he says: 'Ex hisce glandulis, earumque vasis, qui palpebras inter oculique globum observatur, humor procedens, per lacrymalia puncta in nares defluit', 'The fluid flowing from these glands and their vessels, observable between the eyelids and the eyeball, flows down through the punctum lacrimalis into the nose'.

the Bible and the Church fathers (all seen by Petit as making up a single, living tradition) and using the concepts of *spiritus* and humours: but also a 'modern' analysis, based on observation of animal dissection, coming to the conclusion that the function of tears is simply to irrigate the eyes.<sup>20</sup> The role of tears forms part of a wider discussion on the role of the emotions, and how far this changed in the Enlightenment,<sup>21</sup> but the synchronicity of Petit and Stensen also illustrates well how arguments based on analogy, and arguments derived from observation and experimentation, were both being made in 1661. However, at this period, 'experiment' could simply mean 'experience'.<sup>22</sup>

### *Structure and function, movement and stability*

How does physiology fit into the ideals of seeing for oneself, and of a unified medical science? Whereas structure can be discovered by dissection, function cannot easily be seen in the same way;<sup>23</sup> Galen used his observations from dissection as the basis for his theories of physiology but, as Véronique Boudon-Millot points out in her chapter in this collection, he was trying to account for 'a reality that is, by its very nature, unobservable'.<sup>24</sup> His theories of vision, specifically, relied on the invisible *pneuma*, which he believed was so thin and light that it escaped even before the dissection commenced. Boudon-Millot thus extends to the ancient world Cunningham's point that physiology could be seen as the speculative narrative based on the structures shown by anatomical investigations, but adds the further idea that invisible substances could be used as the basis of the speculation.<sup>25</sup>

But it is important to acknowledge that even structure is not 'given' to experience; while some bodily structures, such as a bone or an organ, may appear to be self-evident entities, even here interpretation is needed. For

---

<sup>20</sup> *Existimo itaque lacrymas nihil esse, nisi humorem, qui oculo irrigando destinatus est* (92–93).

<sup>21</sup> See Page Bayne S., *Tears and Weeping. An Aspect of Emotional Climate Reflected in Seventeenth-Century French Literature* (Tübingen-Paris: 1981) and Lange M.E., *Telling Tears in the English Renaissance* (Leiden-New York-Cologne: 1996).

<sup>22</sup> Cunningham, "Old Anatomy – The Sword" 60.

<sup>23</sup> Cunningham, *The Anatomist Anatomis'd* 156.

<sup>24</sup> See the contribution of V. Boudon-Millot 559 in this volume.

<sup>25</sup> Cunningham, "Old Anatomy – The Sword"; see also Cunningham, *The Anatomist Anatomis'd*.



example, early modern treatises often regarded the vagina not as a different organ, but as part of the womb. In early modern medical Latin, the word *vagina* could mean what we call 'the womb', with what we call the vagina being regarded as 'the neck of the womb'.<sup>26</sup> In *European Sexualities, 1400–1800* Katherine Crawford notes that 'Female parts were not distinct enough to merit separate names'.<sup>27</sup> This is rather overstating the situation; while the late medieval infertility treatises studied by Amy Lindgren show 'blurry or even nonexistent' boundaries between the womb, vulva and female testes, writers in this period who focused on anatomy did separate out the 'neck' of the womb as a separate structure.<sup>28</sup> By the early seventeenth century, works such as Bauhin's *Theatrum anatomicum* (1605) included the *fundus*, the *os*, the *cervix* and the various parts of the *pudendum externum*, among them the clitoris and labia. Because early seventeenth-century medical writers accepted Galen's view that women as well as men produce seed, they organised their discussions of the female generative parts on the model of the male body, first describing the vessels that produce, store and evacuate this seed, before moving to the organ of evacuation: the penis or the womb.<sup>29</sup> The perception of structure could thus derive from beliefs about function. Sometimes function led to a belief in a part of the body that we no longer accept. In this collection, Michael Stolberg draws our attention to a previously-unstudied aspect of the early modern body, a space 'between the flesh and the skin', which appears to result from a greater interest in sweat as a means of excreting unhealthy substances. Valeria Gavrylenko goes back to the Homeric poems to ask when 'skin' became a body part, and argues that, while the terms for animal skin, or hide, could be applied to humans in poetic language, the Homeric heroic body is a 'body without skin' in which surface and depth are united, and the whole flesh can 'melt' under the impact of emotion. Even where we agree on the bodily part, our view of it may be very different; for example, Michael McVaugh offers a sense of how our 'kidney' differs from that of Mondino.

<sup>26</sup> See for example Hobby E. (ed.), *Jane Sharp. The Midwives Book, or, the Whole Art of Midwifry Discovered* (New York-Oxford: 1999) xxxi.

<sup>27</sup> Crawford K., *European Sexualities, 1400–1800* (New York: 2007) 106–108.

<sup>28</sup> Lindgren A., *The Wandering Womb and the Peripheral Penis. Gender and the Fertile Body in Late Medieval Infertility Treatises* (PhD thesis, University of California, Davis: 2005) 103; 92–93.

<sup>29</sup> E.g. Bauhin, *Theatrum anatomicum* 214; *ibidem Institutiones anatomicae* 78–80 on the woman's 'vasa spermatica, testes, vasa deferentia seu ejaculatoria'; 80–86 on the womb.

The characterisation of anatomy as static, physiology as concerned with motion, also merits historical study. Sabine Kalff looks at seventeenth-century arguments, that motion was the way to preserve the health of both bodies and states, proposed by writers outside the area of medicine. Tomas Macsotay's paper also looks outside medical views of health and disease to examine how eighteenth-century artists interacted with medicine in their own explorations of the body. He discusses how artistic education at the Paris Royal Academy was criticised for relying on the anatomical model or the posed body, with Diderot proposing the observation of real people moving about as they performed everyday tasks. Diderot admired ancient Greek sculptors, while at the same time taking ideas from Montpellier vitalism.

### *Analogy and metaphor*

In pre-modern medicine, represented for example by Petit, the dominant model of thinking about the function of the body was an analogical one; rather than discussing causality, analogies were drawn between bodily systems, with other aspects of the natural world, and with emerging technologies. The woodcut we have chosen as our cover image is a striking example of analogical thinking. In the third part of his encyclopaedia Ma'aseh Tobiiyyah (*Work of Tobias*), published in Venice in 1708, Tobias Cohn illustrated the human body as a house (fol. 107 recto).<sup>30</sup> One of the first Jews to study medicine in a German university, Frankfurt-am-Oder, Cohn moved to Padua because, as a Jew, he could not graduate at Frankfurt. He then worked in Poland and as a doctor to five successive sultans in Adrianople and then Constantinople. The house of the body divides body space so that, for example, the head is the roof, the spleen the cellar, and the legs the foundations. The functions of the body are seen according to a thermodynamic model that uses comparisons with the apparatus of distillation. Allan has shown how this eclectic representation picks up analogies used by William Harvey and John Donne; the illustration both summarises and transmits the Galenic tradition, and incorporates the

---

<sup>30</sup> Allan N., "Illustrations from the Wellcome Institute Library: A Jewish Physician in the Seventeenth Century", *Medical History* 28 (1984) 324–328; 324 n. 1 discusses the date of this work. On Cohn see <http://www.jewishencyclopedia.com/view.jsp?artid=656&letter=C&search=cohn> accessed 8 January 2011.

newest discoveries.<sup>31</sup> As heat is represented as the motor, the ideas of Descartes and the thermodynamic model of the body are also incorporated.<sup>32</sup>

We have already noted that, while anatomical structures can be discovered by dissection, function can less readily be seen. A further important point follows from this; because physiology cannot base its knowledge on visible structures, it needs to use analogies in a different way. Instead of linking two visible phenomena, physiological analogies have to conceptualise what cannot be seen by the eye. However, anatomical analogies may then lead to assumptions about physiology. In this collection, Elizabeth Craik examines the Hippocratic treatise *On Glands*, which proposed that 'glandular parts belong to an integrated system'. Based on knowledge of comparative anatomy gained in sacrifice and cooking, these glands are said to be 'sponge-like' or 'fat-like' in appearance from a very early date. However, while their appearance was well-known, their function was less easy to discover. *On Glands* itself played little part in early modern discussions, perhaps because it favoured flux theory over humoralism. Furthermore, as physiology studies processes rather than structures, for physiology even the term 'structure' is misleading, resting as it does on the claim of an isomeric structural analogy between visible and invisible parts of bodies. Different types of metaphors are needed in physiology, in particular those borrowed from art and meteorology, as the contributions of Tomas Macsotay and Barbara Orland demonstrate here.<sup>33</sup> Sabine Kalff concentrates on the ways in which views of dynamic motion in physiology interacted with the utopian views of Tommaso Campanella and Francis Bacon, examining in particular the image of the body as a battlefield, with fever, for example, being seen not as a sign of disorder, but as part of the process of healing.

Aristotle described how analogy can connect what is not fully understood with what is known. An example would be his own comment that the formation of the embryo is like the process of turning milk into cheese, discussed here by Karine van 't Land. However, the analogy is capable of more than one use. When Avicenna repeated this analogy, he departed from it in that he considered that the active principle – the rennet, or male sperm – itself became part of the final product. Liba Taub's chapter

---

<sup>31</sup> Allan, "A Jewish Physician in the Seventeenth Century" 327. We thank Ana Resende for bringing this illustration to our attention.

<sup>32</sup> I owe this point to Claus Zittel.

<sup>33</sup> See further on this point Zittel C., *Theatrum philosophicum. Descartes und die Rolle ästhetischer Formen in der Wissenschaft* (Berlin: 2009).

discusses the difference between analogy and metaphor, arguing that, while ‘analogies point to resemblances [...] metaphors may include novelty as an important feature’.<sup>34</sup> As Daniel Schäfer argues, when discussing the image of ageing as a fading flame, analogies to natural or cultural processes regularly served as starting points for medical thinking, or as confirmations of medical conceptions. In the frontispiece to Francis Bacon’s *The Historie of Life and Death* (London, Humphrey Mosley: 1638), a work which Schäfer discusses, scenes of life and death surround the author’s portrait. This metaphor for ageing immediately draws the reader’s attention to the obvious analogies between nature and culture which, for Bacon, become scientific analogies, made possible by the imagination.<sup>35</sup> This kind of *scientiae analogia*<sup>36</sup> was not thought to be a law or even a natural structure, but rather was used as a heuristic tool in the search for experimental knowledge.<sup>37</sup> [Fig. 1]

Schäfer shows both continuity and change in the Early Modern period, when analogies drawn from iatrochemistry (such as fermentation) and iatromechanics (the body as a machine wearing out) came into play. Tamás Demeter’s chapter includes discussion of Hume’s question as to whether the mind is more like a wind instrument, or a string instrument; imagery and practice were closely connected, with Prins’s chapter on Ficino looking not only at ‘the music of the pulse’, but also at the use of music to change the pulse. Kalff shows how Campanella represented the pulse as a drum, summoning the spirits to battle against a fever. The theme of the senses is found in many papers in this collection, with hearing and voice also considered by Wells, and sight by Boudon-Millot and Vanagt.

By the Early Modern period, ancient explanations of physiological phenomena thus existed alongside newly emerging methods of explanation based on the study of nature. Jacomien Prins, however, draws our attention to alternative constructions even of ‘nature’; when Marsilio Ficino talks about it, ‘the “nature” of which [he] speaks is not our observed

<sup>34</sup> See the contribution of L. Taub 42 in this volume.

<sup>35</sup> See for example Jardine L., “*Experientia literata* or *Novum Organum*? The Dilemma of Bacon’s Scientific Method”, in Sessions W.A. (ed.), *Francis Bacon’s Legacy of Texts* (New York: 1990) 47–68; Eamon W., *Science and the Secrets of Nature* (Princeton, NJ: 1994).

<sup>36</sup> *Temporis partus masculis*, in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874), vol. III, 538.

<sup>37</sup> See Bacon Francis, *Novum Organum*, vol. II, nr. 42, in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Albans, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874), vol. I, 316.



Fig. 1. English of Francis Bacon, *The Historie of Life and Death* (London, Humphrey Mosley: 1638); five panels with scenes representing life and death surround the title in the centre. In the top panel, there are animals, trees and figures in a landscape. At the left of this panel is a crowned woman with a wand and the inscription 'Art can slay Natures decay'. To the right, Time holds a book and a scythe. The inscription here is: 'Let time Looke on this booke'. To the left of the title an elderly couple with walking sticks is represented, and to the right mourners amidst dead livestock, as birds fall from the sky. The bottom section has a portrait of Francis Bacon at the centre; to the left, a medallion showing dead animals, with the inscription 'To death all', at the right side another depicting tombs and bones, with the inscription 'At last fall'. Engraving. © Trustees of the British Museum.

nature, but the supernatural nature of the intelligible harmonic realm'. The analogical movement operated in both directions; in meteorology, geology, cosmology, and political and economic theory, analogies and metaphors derived from physiology could be used. This was not simply an early modern phenomenon; Liba Taub's chapter looks at the use of physiological analogies in ancient meteorology, an area that would today be seen as 'geology', and shows how the imagery of digestion, in particular, was applied to other areas of the ancient 'enquiry into nature' such as the cause of earthquakes. She reminds us of Piet Schrijvers' comments on Lucretius, noting that the use of physiological analogies, by referring to the familiarity of the human body, can make otherwise daunting natural phenomena less terrifying. 'What', Taub asks, 'is more familiar to us than our own bodies, and the processes they undergo?'<sup>38</sup>

In the frontispiece to a 1664 publication by Lewenheimb (Philipp Jakob Sachs von Lewenheimb, 1627–1672),<sup>39</sup> we find a rare example of a pictorial representation of such analogies between meteorology and physiology. [Fig. 2]

The comparison between the veins of the earth and of the body had been used to explain weather since Aristotle (Arist. *Mete.* 32a); it was still firmly established in the scientific communities of the seventeenth century,<sup>40</sup> and can be found even in Harvey and Descartes. In his *Principia* Descartes went so far as to compare explicitly the circulation of the blood discovered by Harvey, and the weather cycle.<sup>41</sup> The French edition of the *Principia* includes further interesting additions: 'De façon que le cours de l'eau en cette Terre imite celui du sang dans le corps des animaux, où il

<sup>38</sup> Schrijvers P., "Seeing the Invisible: A Study of Lucretius' Use of Analogy in *De rerum natura*", in Gale M. (ed.), *Oxford Readings in Classical Studies. Lucretius* (Oxford: 2007) 255–288; see the contribution of L. Taub 58 in this volume.

<sup>39</sup> For Lewenheimb see Margulis L. – Sagan D., *Dazzle Gradually. Reflections on the Nature of Nature* (White River Junction, VT: 2007) 157–158.

<sup>40</sup> Cf. Perrig A. "Leonardo: die Anatomie der Erde", *Jahrbuch der Hamburger Kunstsammlungen* 25 (1980) 51–80. Thanks to Claus Zittel for this example and for the bibliography discussing it.

<sup>41</sup> 'Atque ita, ut animalium sanguis in eorum venis et arteriis, sic aqua in terrae venis et in fluviis circulariter fluit', Descartes, *Principia*, vol. IV § 6, Adam C. – Tannery P. (eds.), *Œuvres de Descartes* (Paris: 1897–1913), vol. VIII, 244). Cf. Harvey, *De motu cordis* ch. 8; Gregory A., "Harvey, Aristotle and the Weather Cycle", *Studies in History and Philosophy of Biological and Biomedical Sciences* 32 (2001) 153–168; Pulkkinen J., "The Role of Metaphors in William Harvey's Thought", in Zittel C. – Engel G. – Nanni R. (eds.), *Philosophies of Technology. Francis Bacon and his Contemporaries* (Leiden-Boston: 2008) 253–286.





Fig. 2. Frontispiece to Philippi Jacobi Sachs a Lewenheimb, *Phil. et Med. D. et Collegii Naturae-Curiosorum Collegae Oceanus Macro-Microcosmicus seu Dissertatio Epistolica De Analogo Motu Aquarum ex et ad Oceanum, Sanguinis ex et ad Cor. / ad [...] Dn. Thomam Bartholinum, Medicum et Anatomicum Incomparabilem Professorem Regium Honorarium, et Decanum Fac. in Regia Hafnensi Perpetuum* (Wroclaw, Fellgiebel: 1664).

fait un cercle en coulant *sans cesse fort promptement de leurs veines en leurs arteres, et de leurs arteres en leurs veines*'.<sup>42</sup>

*Change, continuity and authority*

A major theme of this collection is that what appears to be 'new' in early modern writing may not in fact be new at all, but may derive from the ancient texts with which writers in early modern Europe were often very familiar. Many ideals of Greek medicine were inherited by Renaissance and early modern writers. Claims are still made for the 'Greek miracle'; for the origin of rationality in medicine, the retreat from superstition and magic, and the emergence of the belief that natural causes lie behind disease, and that natural substances can cure it. This can of course be overstated; the Hippocratic writers of the classical Greek period rarely attack religion, for example, and where they do, they attack individual wandering healers but not the religion of the city-state. In Greek medicine, there is always debate; there are claims to knowledge in which it is important where that knowledge came from. Contrary to the standard legend of the historiography of science, which locates only in the Early Modern period the shift from the 'book' of the classical authority to first-hand observation by the individual, such claims are often based on one's own eyes – 'I myself have seen', as in *Nature of the Child*<sup>13</sup> where the writer claims to have seen a very early conception – or in the appeal to the individual case history, to the patient, as in the seven books of the Hippocratic *Epidemics*. This raises questions about the validity of experience, and the relevance of the individual case. Rina Knoeff's paper for this collection shows how Boerhaave was doing 'armchair medicine', based 'on conceptual reasoning; it was a medical system which had little to do with the discussion and treatment of individual cases'. In this sense, early modern physiology was a long way from the idealisation of observation and the individual case of Hippocratic Greece. Even the concept of 'empirical research' was very different in the Early Modern period, a point addressed by Marlen Bidwell-Steiner. Rainer Brömer reminds us of the conflicts in the Islamic world between those who followed the Greek philosophers and those who argued from 'scripture and prophetic traditions'.

---

<sup>42</sup> Descartes, *Principes*, in *Œuvres de Descartes*, vol. IX, 237.



After the Middle Ages, Aristotle continued to dominate the field of scientific writing, and perhaps most famously has been seen as contributing to Harvey's work by suggesting that the circle is the most perfect shape, but many other ancient texts continued to hold appeal for Renaissance and early modern scientists; for example, Lucretius' *De rerum natura*, discussed here by Fabio Tutrone, who focuses on Lucretius' views on the nature of 'matter' and his role in the acceptance of atomistic theories in sixteenth- and seventeenth-century physiology; or Hippocrates, regarded by Boerhaave as compatible with Harvey. Stoic and Epicurean philosophy also had a lasting influence on images of the body, as Bidwell-Steiner argues when looking at sixteenth-century Italian and Spanish writers. In his *True Intellectual System of the Universe* (1678), Ralph Cudworth presented the great thinkers of the past and the present as forming a continuous thread of insight, offering answers to the same questions, but using terminology that had often obscured the concordance between them. As Diana Stanciu shows here, his concept of 'plastic nature' drew on sources including Plato, Aristotle, Plotinus, the Stoics, Galen, Harvey, Paracelsus and van Helmont. Cudworth presented plastic nature as an immaterial and immanent force in both nature and living things, thus offering a challenge to a mechanistic physiology in the style of Descartes. Tracing the reception of Ibn al-Nafis and his supposed 'discovery' of the pulmonary transit, Rainer Brömer reminds us that links existed not only across time, but also across space, in this case between opposite ends of the Mediterranean, and across the Muslim world.

Furthermore, where technological change may lead us to expect that ancient ideas would be challenged, this was not necessarily the case. Sometimes analogies could be adapted to fit a new situation. Tamás Demeter concentrates on the eighteenth century, after Newton, and challenges the view according to which Hume drew from mechanical models, arguing instead that he was closer to vitalist physiology. Hume, Demeter argues, applied the 'language of natural phenomena to the moral domain'.

In the seventeenth century, the new technology of microscopy confirmed the established view that the skin was porous, and shifted the focus from the substance to the spaces in between, but Mienieke te Hennepe shows here how the ancient image of a fisherman's net, taken from Plato's *Timaeus*, continued to be used. The intellectual approach to the skin altered, but – despite some evidence of patients experiencing their bodies differently because of the new knowledge – not the practical expression of this knowledge in medical treatment. Microscopic viewing of the skin was followed by an increased interest in the physiology of sweat. Michael Stolberg

also examines changes in the understanding of skin in this period, including the argument that visible sweat was produced by specific tiny glands, with 'insensible transpiration' occurring through tiny pores. Above all, he emphasises the enormous range of types of sweat that can be found in early modern medical writing.

### *Spirits and blood*

Across the papers collected here, two aspects of physiology recur in many different guises: spirits and blood. The first is alien to us, and invisible, while the second is all too familiar to our experience, but we may be surprised at the range of variations in each that can be explored.

Julius Rocca, for example, focuses on the role of 'spirits' in the body. He looks at Galen's 'natural *pneuma*', showing how valuable it is in thinking about the body precisely because it is 'indeterminate, invisible, and, above all, malleable'.<sup>43</sup> He traces its origins and also its fortunes in Galenism, in both late antique and Arabic medicine, showing how, as an analogical model, it survived especially in non-experimental physiological systems. Brömer examines the role of 'spirit', and the substance from which it is made, in Ibn al-Nafis, arguing that it is the theological basis of the argument, rather than any anatomical study of the body, that leads Ibn al-Nafis to argue against a permeable septum in the heart. Sergius Koderá argues for the role of the technology of distillation in transforming the role of 'spirits' in the fifteenth to seventeenth centuries; 'spirits' provided a model by which physiological phenomena such as digestion could be explained, accounted for human ageing, and provided explanations for health and disease that differed from those offered by the humoral system. Koderá contrasts the Neoplatonic Ficino, who used the imagery of distillation but did not appear to have been involved with the practical use of the still, with the Paracelsian Duchesne, who used the knowledge he had gained from observation in his personal experience of distilling liquors. Koderá shows how the art of distillation could apply to both the macrocosm and the microcosm; in the work of Bacon, the body is a still, and cooling all of the body except the stomach is necessary to keep the 'spirits' in check and prolong life. In another version, proposed by Bernardino Telesio, 'spirits' also feature in the papers of Tutrone, Kalff and Bidwell-Steiner, while the

---

<sup>43</sup> See the contribution of J. Rocca 634 in this volume.

role of *pneuma* in vision is discussed by Boudon-Millot. Vanagt's paper on the development of the *camera obscura* illustrates the challenges to 'spirits' in accounts of the process of seeing, and the use of physiological experiments to cut through the apparent impasse between the differing views concerning sight in the ancient authorities; in 1632, looking at the camera obscura from a medical point of view, Plempius urged his readers to dissect for themselves the eye of a freshly-butchered ox.

Several papers address different aspects of blood, one of the canonical four humours, but important far beyond the others in conceptions of the body. Their authors note not only that there were thought to be different kinds of blood, as Catrien Santing shows for Andrea Cesalpino in particular, but also that fluids can be understood as being composed of other fluids – thus, blood includes water and serum – with ideas about one fluid influencing those about another. The word serum, as Stolberg reminds us, comes from the Latin for 'whey', the liquid by-product of cheesemaking. The skin is thus represented as a sieve. McVaugh looks at early discussions of whether the kidney is a strainer, separating liquid from solid, or a sieve, removing smaller solid particles and not the larger; for Galen, sometimes it is one, but sometimes the other. McVaugh argues that 'Galen appears to think mechanically up to the point where he has to conclude that mechanical explanation will no longer work, at which point he turns to attraction as an explanatory principle'.

Barbara Orland discusses the use of analogy in thinking about the unseen parts of the body, taking as her focus the analogy between blood and milk, derived from Aristotle. The analogy worked both ways: milk could be seen as 'white blood' while blood could be seen as 'slightly coloured' milk. The model survived to the nineteenth century, but it is important to understand how it was adjusted in order to survive in different contexts. Indeed, how far was this an 'analogy', and how far did it indicate that the two fluids were seen as different forms of a single fluid? Using Cornelis Bontekoe's *Life, Health, Illness and Death* (1684), Orland counters Laqueur's claims for the 'fungibility' of fluids,<sup>44</sup> instead insisting that blood and milk were seen as different substances, while Bidwell-Steiner shows how, a century earlier, Oliva Sabuco had challenged the idea that sperm and milk were formed from blood.

---

<sup>44</sup> Laqueur T., *Making Sex. Body and Gender from the Greeks to Freud* (Cambridge, MA: 1990).

This interest in the transformation of fluids and the degree to which they are separate is common to many papers here. Marion Wells draws our attention to Webster's *Duchess of Malfi*, where Bosola says of his unexpected tears, 'These tears, I am very certain, never grew | In my mother's milk'. A similar interest can be found in Jacomien Prins's comments on the Italian Renaissance philosopher Marsilio Ficino, for whom phlegm comes out through sweat and tears while, in the harmonious body, the blood should contain an ideal balance of the other humours. Michael McVaugh links the question of analogy to that of the relationships between bodily fluids; Berengario da Carpi uses a complex analogy in which sweat, milk and urine come together, so that urine is 'sweated out like milk from the breast'. Michael Stolberg notes how, in Galen, sweat and urine were formed from the same matter, and both contained bile, while inadequate loss of one of the two fluids could be compensated by a greater evacuation of the other.

In order to explore how the analogy between blood and milk was used in medical practice, Orland looks at the fields of generation, where the supposed 'sympathy' between womb and breasts was regarded as a possible source of disease, and nutrition, particularly of the foetus. Orland investigates in particular how the analogy survived when a humoral model was replaced in the seventeenth century by the mechanical 'hydraulic body', and when the amniotic fluid came to be seen not as waste material, but as a form of milk. She concludes that blood came to be seen as 'red milk', while 'milk' was set in a new relation to 'white chyle'. Interestingly, she argues, the idea of blood circulation served only to strengthen the old assumptions about materials moving within the body.

Blood in the female body is also discussed by Baert, Sidgwick and Kusters, who examine the representation in the late antique and early medieval world of the Biblical figure of the 'woman with the issue of blood', healed by touching the hem of Christ's garment. The story was used to articulate concerns about menstruation and purity, with the Haemorrhoida being enlisted on both sides of the debate. While visual arts shied away from showing her bleeding, they suggested this with strategically-placed wells or fountains. Meanwhile the materials of magical healing – gems, amulets and spells – used her as a figure of power, not only because of the power she draws from Christ, but also because of her own faith in believing in his healing potential. Catrien Santing emphasises the close connections between Christian and medical approaches to blood in the sixteenth century. The subject of one of her two case studies, Levinus Lemnius, praised the man dominated by the humour of blood, but embedded his Galenic

views within a firmly Christian framework. The other, Andrea Cesalpino, linked the four blood vessels of the heart to the four rivers of Paradise.

In medieval and early modern medical writing, menstrual blood was seen both as 'filthy' and as laudable since, although it was regularly expelled, it also acted as nourishment for the foetus. Wells invites us to consider the pregnant body as a location in which the foetal mind is affected by the mental state of its mother. Karine van 't Land looks at the connections between generation and nutrition; in both processes, creating respectively a new being, and new tissue, blood was thought to play a central role. She charts the complex variations on the fluids blood and semen, starting from the point that 'According to the medieval medical tradition, sperm and menstrual blood left their traces in the body during the whole course of life'. Some parts – those that were hard and white, like the bones – were thought to derive from semen, others from blood. But this was by no means the end of the story. Both sexes produced two different types of 'sperm', while the term *menstruum* could in medieval literature include 'female sperm'. Concentrating on four medieval commentaries on Avicenna, van 't Land shows how tissue formed from different fluids was thought to behave differently during a person's life, with parts formed from blood having a greater capacity to regenerate than those formed from sperm; this, then, concerned far more than generation. Bidwell-Steiner introduces us to a very different model of the female body, proposed by a woman; the seventeenth-century Oliva Sabuco, whose maternal metaphors were part of a materialist model of the body in which menstrual blood nourished the single fluid which, for her, replaced the three Galenic spirits.

### *Conclusion*

While the papers collected here show the different possible meanings of 'physiology' and help us to see that ideas about the function of the body are historically specific and culturally determined, what wider lessons for the history of medicine and of the body can be taken from these studies? The most important may simply be to bear in mind the links between different genres of writing. For example, Lewenheimb and Lohenstein shared a publisher, and this could facilitate the exchange of physiological metaphors and concepts between medicine and literature, a topic covered here by the papers of Wells and Kalff. In Lohenstein's plays, for instance in his *Agrippina* (1665), the temperaments of the characters are explained by

using the physiological concepts of the time; the hearts of Agrippina and Nero are sometimes soft or hard, cold or hot.<sup>45</sup>

Several papers challenge the periodisation of the history of the body and our tendency to set up milestones. For example, as we have seen, Nutton argues against the 'traditional ascription to Jean Fernel of the creation of physiology as a specific area of medicine' while McVaugh takes issue with those who wish to identify Mondino, Vesalius or Malpighi as discoverers of the modern kidney: 'changes were already occurring in the perception of that organ well before Malpighi wrote, indeed before Harvey's proclamation of the circulation in 1628'.<sup>46</sup> The collection as a whole also challenges the category of 'Early Modern', as it illustrates the continuities between the Ancient and the Modern world, and includes several papers that examine the Enlightenment. Tomas Macsotay, for example, looks at medical knowledge in eighteenth-century philosophers, focusing on the relationship between medicine and artistic production, in particular how images of suffering were read, while Tamás Demeter looks at Hume's relationship both to mechanism and to vitalism. Rainer Brömer further challenges our need to create a story of discovery, in this case of 'the circulation of the blood', showing that 'when Ibn al-Nafis, Servet, İtaki, al-'Atţār, and finally the twentieth-century historians of medicine talk about the structure and function of the cardio-pulmonary system, they are not speaking of the same "thing"'.<sup>47</sup>

Many contributors also interrogate the concept of 'humoral' medicine. Wells, for example, uses Webster's *Duchess of Malfi* to investigate how valid a humoral model was for interpreting mental symptoms in the seventeenth century, and asks whether the passions caused humoral imbalance, or humoral imbalance generated the passions, a question also addressed by Santing. Stahnisch argues that, by the end of the eighteenth century, conditions formerly linked to the humours were coming to be more closely tied to specific bodily organs. Several essays introduce very different ways of modelling the body, such as Telesio's view that

---

<sup>45</sup> Cf. Brancaforte C., "Liebesmetaphorik in Lohensteins Agrippina im Lichte wissenschaftlicher Debatten des 17. Jahrhunderts", *Daphnis* 12 (1983) 305–320; Rahn T., "Affektpathologische Aspekte und therapeutische Handlungszytate in Lohensteins 'Agrippina'" in Benzenhöfer U. – Kühmann W. (eds.), *Heilkunde und Krankheitserfahrung in der Frühen Neuzeit. Studien am Grenzrain von Literaturgeschichte und Medizingeschichte* (Tübingen: 1992) 201–227 and Rahn T., "Anmerkungen zur Physiologie der Liebesblicke in Lohensteins 'Agrippina'", *Simpliciana* 14 (1992) 163–176. I owe these references to Claus Zittel.

<sup>46</sup> See 105 in this volume.

<sup>47</sup> See 359–360 in this volume.

conflict between the Sun and Earth was responsible for all things (Bidwell-Steiner), or Campanella's presentation of hot and cold as the adversarial forces, their rivalry having a creative effect (Kalf).

One aspect that we would like to have addressed in more detail is that of the patient's experience of the body. Frank Stahnisch addresses the theme of tears through the experiences of a famous patient, Johann Gottfried von Herder. He argues that Herder's experiences not only of suffering from repeated infections due to a blocked tear duct, but also of unsuccessful surgical treatment, led him to examine the place of tears in the human condition, first through medical training and then through philosophy and theology. As a result, Herder went beyond Haller's theories of 'irritability' and looked forward to a future 'physiologist of both the soul and the body of man' (*Ein Physiologe der Seele und des Koerpers des Menschen*).<sup>48</sup> The place of the soul, and of consciousness, in the body is another area which we would like to have developed; for example, Brömer discusses the corporeality of the soul in Islamic medicine, and Stanciu looks at Cudworth's metaphor of the 'sleeping musician', whose musical skill is still within him, even when he is not himself conscious of it.

Nevertheless, we hope that the individual papers presented here, as well as this collection as a whole, will present a challenge to existing master narratives of 'continuity' and 'progress', by showing the many variations across time and space in early modern Europe, broadly conceived. We would like to see this book as the start of a process of greater dialogue not only between those working in different periods, but also different academic disciplines. The relative ranking of physiology and anatomy has shifted over time, with physiology being seen as the prior field of knowledge; as the speculative side of anatomy; and as a sub-discipline of anatomy. But only if we talk to each other, and share our knowledge, will we be able to understand what physiology meant in the past.

---

<sup>48</sup> Herder J.G. von, *Zum Sinn des Gefuehls* (1800) in Pross, "Herder – Werke", vol. II, 244.



### Selective bibliography

- ALLAN N., "Illustrations from the Wellcome Institute Library: A Jewish Physician in the Seventeenth Century", *Medical History* 28 (1984) 324–328.
- BACON FRANCIS, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D. (London: 1858–1874).
- BAUHIN CASPAR, *Institutiones Anatomicae Corporis Virilis et Muliebris Historiam Exhibentes* (Berne?, J. Le Preux: 1604).
- , *Theatrum anatomicum* (Frankfurt, M. Becker: 1605).
- BONTEKOE CORNELIS, *Korte verhandeling van's menschen leven, gezondheid, siekte, en dood, begrepen in een drie ledige reden* (The Hague, Pieter Hagen: 1684).
- BRANCAFORTE C., "Liebesmetaphorik in Lohensteins Agrippina im Lichte wissenschaftlicher Debatten des 17. Jahrhunderts", *Daphnis* 12 (1983) 305–320.
- COHN TOBIAS, *Ma'aseh Tobiyah* (Venice, Bragadin Press: 1708).
- CRAWFORD K., *European Sexualities, 1400–1800* (New York: 2007).
- CUDWORTH RALPH, *The True Intellectual System of the Universe* (London: 1678).
- CUNNINGHAM A., *The Anatomical Renaissance. The Revival of the Anatomy Projects of the Ancients* (Aldershot: 1997).
- , *The Anatomist Anatomis'd. An Experimental Discipline in Enlightenment Europe* (Aldershot: 2010).
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.
- DESCARTES, RENÉ, *Œuvres de Descartes*, eds. Adam C. – Tannery P., Paris: 1897–1913.
- DES CHENE D., *Life's Form. Late Aristotelian Conceptions of the Soul* (Ithaca, NY: 2000).
- , *Physiologia. Natural Philosophy in Late Aristotelian and Cartesian Philosophy* (Ithaca, NY: 1996).
- EAMON W., *Science and the Secrets of Nature* (Princeton, NJ: 1994).
- EGMOND F. – ZWIJNENBERG R. (eds.), *Bodily Extremities. Preoccupations with the Human Body in Early Modern European Culture* (Aldershot: 2003).
- GREGORY A., "Harvey, Aristotle and the Weather Cycle", *Studies in History and Philosophy of Biological and Biomedical Sciences* 32 (2001) 153–168.
- HALL T., *History of Physiology 200 BC to AD 1900* (Chicago: 1975).
- HILLMAN D. – MAZZI C. (eds.), *The Body in Parts. Fantasies of Corporeality in Early Modern Europe* (London-New York: 1997).
- HOBBY E. (ed.), *Jane Sharp. The Midwives Book, or, the Whole Art of Midwifry Discovered* (New York-Oxford: 1999).
- HUISMAN T., *The Finger of God. Anatomical Practice in 17th-century Leiden* (Leiden: 2009).
- HUNTER WILLIAM, *Two Introductory Lectures, Delivered by Dr William Hunter, to his Last Course of Anatomical Lectures* (London, Printed by order of the Trustees, for J. Johnson: 1784).
- JARDINE L., "Experientia literata or Novum Organum? The Dilemma of Bacon's Scientific Method", in Sessions W.A. (ed.), *Francis Bacon's Legacy of Texts* (New York: 1990) 47–68.
- KING H., "Inside and Outside, Cavities and Containers: The Organs of Generation in Seventeenth-Century English Medicine" in Baker P. – Land-van Wesenbeeck K. van 't (eds.), *Medicine and Space. Body, Surroundings, and Borders in Antiquity and the Middle Ages* (Leiden: 2011) 37–60.



- LANGE M.E., *Telling Tears in the English Renaissance* (Leiden-New York-Cologne: 1996).  
 LAQUEUR T., *Making Sex. Body and Gender from the Greeks to Freud* (Cambridge, Mass.: 1990).  
 LINDGREN A., *The Wandering Womb and the Peripheral Penis. Gender and the Fertile Body in Late Medieval Infertility Treatises* (Davis: 2005) (PhD thesis, University of California).  
 MARGULIS L. – SAGAN D., *Dazzle Gradually. Reflections on the Nature of Nature* (White River Junction, VT: 2007).  
 PAGE BAYNE S., *Tears and Weeping. An Aspect of Emotional Climate Reflected in Seventeenth-Century French Literature* (Tübingen-Paris: 1981).  
 PARK K., *Secrets of Women. Gender, Generation and the Origins of Human Dissection* (Brooklyn, NY: 2006).  
 PERRIG A. "Leonardo: Die Anatomie der Erde", *Jahrbuch der Hamburger Kunstsammlungen* 25 (1980) 51–80.  
 PETITUS PETRUS, *De lacrymis libri tres* (Paris, Claudius Cramoisy: 1661).  
 PORTER J. (ed.), *Constructions of the Classical Body* (Ann Arbor, MI: 1999).  
 PULKKINEN J., "The Role of Metaphors in William Harvey's Thought", in Zittel C. – Engel G. – Nanni R. (eds.), *Philosophies of Technology. Francis Bacon and his Contemporaries* (Leiden-Boston: 2008) 253–286.  
 RAHN T., "Affektpathologische Aspekte und therapeutische Handlungszitate in Lohensteins 'Agrippina'", Benzenhöfer U. – Kühlmann W. (eds.), *Heilkunde und Krankheitserfahrung in der Frühen Neuzeit. Studien am Grenzrain von Literaturgeschichte und Medizingeschichte* (Tübingen: 1992) 201–227 [= *Frühe Neuzeit* 10].  
 —, "Anmerkungen zur Physiologie der Liebesblicke in Lohensteins 'Agrippina'", *Simpliciana* 14 (1992) 163–176.  
 ROTHSCUH K., *History of Physiology*, tr. Risse G. (Huntington, NY: 1973).  
 SANTING C., *The Heart of the Matter. Signification and Iconic Reification of Human Remains at the Papal Court, c. 1450–1600* (forthcoming).  
 SCHRIJVERS P., "Seeing the Invisible: A Study of Lucretius' Use of Analogy in *De rerum natura*", in Gale M. (ed.), *Oxford Readings in Classical Studies. Lucretius* (Oxford: 2007) 255–288.  
 STAENSEN NIELS, *Disputatio anatomica de glandulis oris, et nuper observatis inde prodeuntibus vasis prima* (Leiden, Johannes Elzevir: 1661).  
 —, *Observationes Anatomicae, quibus varia oris, oculorum, et narium vasa describuntur, novique salivae, lacrymarum et muci fontes deteguntur, et novum nobilissimi Bilsii de lymphae motu et usu commentum examinatur et rejicitur* (Leiden, Jacobus Chouët: 1662).  
 TANSEY E.M., "The Physiological Tradition" in Bynum W.F. – Porter R. (eds.), *Companion Encyclopedia of the History of Medicine* (London: 1993), vol. 1.  
 ZITTEL C., *Theatrum philosophicum. Descartes und die Rolle ästhetischer Formen in der Wissenschaft* (Berlin: 2009).

PART ONE

HISTORY OF PHYSIOLOGY IN CONTEXT:  
CONCEPTS, METAPHORS, ANALOGIES



## PHYSIOLOGIA FROM GALEN TO JACOB BORDING

Vivian Nutton

### *Summary*

Jean Fernel is frequently quoted as the Father of Physiology. Yet the word and concept in medicine can be traced back at least to the first century AD, and it became one of the standard divisions of medicine in late-antique Galenism. Galen himself is ambivalent as to its value within medicine. In 1542 Fernel produced his recasting of Avicenna's *Canon* in a more Galenic form under the title, *On the Natural Part of Medicine*. It encompassed elements, mixtures, humours, spirits, faculties and anatomy, standard features of medieval Galenism. In 1554, in his second edition, Fernel (or his editor) altered the title to *Physiologia*, but without making any substantial changes to his text. For Fernel, and for his successors down to the nineteenth century, anatomy, in the sense of a description of the body's structures, remained an essential part of all treatises entitled *Physiology*, and vice-versa.

This paper is an appeal for clarity, not because of a wish to accuse others of obfuscation, but because of the ambiguities inherent in the very term 'physiology'. The definition of physiology has altered over the centuries, and, indeed, is still changing; and what doctors understood by physiology in the twentieth century, and, as a consequence, the concepts which twenty-first century historians bring to writing about earlier medicine, differ from the use of the word in the sixteenth century, let alone in the period of the Roman Empire. It is a failure to take due note of this fluidity that lies behind the traditional ascription to Jean Fernel of the creation of physiology as a specific area of medicine. This accolade, which goes back at least to the distinguished physiologist Sir Charles Sherrington, is more than a little dubious, for what Fernel and his successors for centuries understood by the term was far wider than Sherrington and his followers have believed.<sup>1</sup>

---

<sup>1</sup> Sherrington C., *The Endeavour of Jean Fernel* (Cambridge: 1945), entitles his central chapter, 60–97, 'The earliest physiology'. By contrast, Figard L., *Un médecin philosophique au XVI<sup>e</sup> siècle* (Paris: 1903) 60, rightly declared that 'Il y a dans la *Physiologie* de Fernel beaucoup de métaphysique et peu de physiologie au sens que nous le donnons' (emphasis mine).

For enlightenment on the history of physiology English readers naturally turn to the classic two volumes by Thomas S. Hall, published forty years ago under the title, *Ideas of Life and Matter. Studies in the History of General Physiology*, a more appropriate title than that of the second impression of 1975, *History of General Physiology*. Publishers, as we shall see, have a greater deal of responsibility for misinformation than authors. Hall set his excellent survey of some aspects of the history of physiology into the wider context of an enquiry into essential differences between living and non-living things, to 'the global exploration of life which it seems proper to call general physiology'.<sup>2</sup> His examples include respiration, assimilation, developmental differentiation, indeed almost any activity of an organism. A similar list can be found in Fulton and Wilson's selection of texts on the history of physiology, but like Karl Rothsschuh, neither author bothers to define physiology.<sup>3</sup> More interesting, for my purposes, is the example of Kenneth Franklin a generation earlier in his *Short History of Physiology*. Having rightly observed in his introduction that 'the limitation of physiology to knowledge of the normal functioning of organisms or their constituent parts is an innovation of the last 100 years, i.e. post-1840', he then proceeded to ignore his own advice in the rest of his book.<sup>4</sup>

My point here is to post a warning notice, no more, to those who agree with Hall in thinking of physiology solely as the study of the activities and processes of the body. One should be careful about assuming that when an ancient or a Renaissance doctor talked in terms of physiology he understood by it what we mean today. It is well known, certainly among classicists, that, for the most part, when the Greeks used the word *physiologia* and its cognates, they were referring not to a branch of medicine but to an investigation into nature as a whole. Several of the pre-Socratics are said to have practised *physiologeîn*, and although we may prefer to see the word as a coinage of the fourth rather than the fifth or sixth century BC, there can be no doubt that within a generation of Aristotle's death, if not sooner, the word had entered common use. Certainly, by using *Physiologos* as the title of a play at the end of the fourth century, the comedian

<sup>2</sup> Hall T.S., *History of General Physiology 600 B.C. to A.D. 1900* (Chicago-London: 1975) ix. The first edition was published by the same press in 1969.

<sup>3</sup> See the list of contents in Fulton J.F. – Wilson L.G., *Selected Readings in the History of Physiology* (Springfield, IL: 1966) vii.

<sup>4</sup> Franklin K.J., *A Short History of Physiology*, ed. 2 (London-New York: 1949) 13. Rothsschuh K., *History of Physiology* (Huntington, NY: 1973) (originally in German, 1953) says nothing about Fernel. He says more about Fernel in his *Physiologie. Der Wandel ihrer Konzepte, Probleme und Methoden vom 16. bis 19. Jahrhundert* (Freiburg-Munich: 1968) 41–47.

Sopater was telling his audience in advance who was going to be the butt of his jokes, and expecting them to laugh at the peculiarities of a natural scientist.<sup>5</sup>

When the word *physiologia* entered medical discourse is uncertain, but it was certainly before the time of Galen, for the author of the pseudo-Galenic *Medical Definitions* specifies as one of the five standard divisions of medicine, 'which some people have called species, the physiological, the pathognomonic, the dietetic, the material, and the therapeutic. The physiological is that which treats of the investigation, *theoria*, into the power of nature that organises and regulates us'.<sup>6</sup> It was also known to the Methodist Soranus, writing his *Gynaecology* in the early years of the second century AD, for his tripartite division also includes physiology.<sup>7</sup>

That the physiological was a particular favourite of dogmatic or rationalist doctors by contrast with the Methodists or Empiricists is stressed by another pseudo-Galenic writer, the author of the *Introduction to Medicine*.<sup>8</sup> He appeals to Hippocrates for the notion that the study of nature is the foundation of medicine, paraphrasing *Places in Man* 2.1, and asserting that the rationalists emphasise physiology for two reasons.<sup>9</sup> It allows them firstly to understand the natural state of an individual body in order to determine the extent to which any phenomenon is natural or unnatural, and, secondly, to use their knowledge of the nature of their remedies to select whatever is most appropriate to a given case.<sup>10</sup> This author, too, includes the physiological among five canonical subdivisions of medicine,

<sup>5</sup> Sopater, quoted by Athenaeus, *Deipnosophistae* 3.101a.

<sup>6</sup> Galenus, *Definitiones medicae* 11 (19.351 K.). For the date of this author, an older contemporary of Galen, see Kollesch J., *Untersuchungen zu den pseudogalenischen Definitiones medicae* (Berlin: 1993).

<sup>7</sup> Soranus, *Gynaecia* 1.1.2 and 3.3.5.

<sup>8</sup> Galenus, *Introductio seu medicus* 7 (14.689–690 K.). The author is also likely to have been a contemporary of Galen, see Petit C., *Edition critique, traduction et commentaire de l'Introductio sive Medicus du Pseudo-Galien* (Thesis Paris IV–Sorbonne: 2004) LIII–LVIII, LXIV–LXV; published as (ed., trans.) Galien. *Tome III. Le Médecin. Introduction* (Paris: Les Belles Lettres, 2009).

<sup>9</sup> For this tract, see now Craik E.M., *Hippocrates, Places in Man* (Oxford: 1998), although, 30, she refuses to commit herself to identifying this and other passages in *Definitions* as coming from *Places in Man*. The choice of text is interesting, not least because *Places in Man* is not rated highly by Galen, who appeals far more often to the more famous *On the Nature of Man*; see the references in Galen assembled by Anastassiou A. – Irmer D., *Testimonien zum Corpus Hippocraticum* (Göttingen: 1997–2006), vol. II.1, 322–327, II.2, 249–251, and cf. I.297, 301. The author's preference for *Places in Man* is further proof that a more rigid Hippocratism developed after Galen; see Nutton, V. "The Fatal Embrace: Galen and the History of Medicine", *Science in Context* 18 (2005) 111–121.

<sup>10</sup> Galen, *Introd. s. medic.* 2 (14.677–678 K.). Similar comments at 8 (14.695 K.).

which, unlike the author of *Definitions*, he then subdivides further into three: 'The five basic divisions of medicine are as follows, the physiological, the aetiological or pathological, the hygienic, the semiotic and the therapeutic. Athenaeus uses "the material" instead of "the semiotic". The physiological is that part where we discuss the natural make-up (*to phusikon*) of Mankind. It is divided further into three parts, an account of the elements of which Mankind is constituted, genesis and foetal development, and, thirdly, the investigation of the internal and external parts of the body when we dissect or describe the bones'.

Ludwig Englert suggested that this five-fold division long antedated the age of Galen, arguing, probably rightly, that if it is Athenaeus of Attaleia who is said to have held a different opinion about one of the constituents, then that definition must already have been current around 80 AD.<sup>11</sup> His further suggestion that in some way or other it went back to Erasistratus in the early third century BC is, however, implausible, even if it would provide some justification for one of the surprises in this investigation: Galen's less than fulsome praise of *physiologia*.<sup>12</sup> In the opening chapter of *On the Divisions of the Medical Art*, Galen uses physiology and pathology to exemplify subdivisions within medicine that have been introduced relatively recently, and are not universally accepted. He repeats this view later on in chapter 6, attributing the creation of these subdivisions to the very vague 'some people', but refraining from endorsing them himself.<sup>13</sup> Elsewhere, his use of both noun and verb typically retains much of the original sense of the word as an investigation into the *phusis*, the nature, of a thing: he talks, for example, of those who physiologise about thunder, the weather or water.<sup>14</sup> At other times he uses the word to characterise the ways in which his teachers or his opponents adopt different ways of understanding the whole natural world, of which mankind is but one part, i.e. the underlying

<sup>11</sup> Englert L., *Untersuchungen zu Galens Schrift Thrasybulos* (Leipzig: 1929) 22–23. The fact that Celsus a generation earlier does not use the term or this division might suggest that this division was devised around AD 70, but the argument from silence is weak.

<sup>12</sup> Englert may have been misled by Galen's discussion of Erasistratus' relationship to the physiological theories of others at *De facultatibus naturalibus* 2.4 (2.88–92 K.), which proves only that Galen believed that Erasistratus had adopted a wrong basic physiology, not that he had used the term to describe his activities. Roths Schuh, *Physiology* 13, wrongly declares that Galen used the word only once, citing the pseudo-Galenic *Introduction*.

<sup>13</sup> Galenus, *De partibus artibus medicativae* 1 and 6, CMG, Suppl. Or. II, 120, 124.

<sup>14</sup> Galenus, *De constitutione artis medicae* 1 (1.227 K.); *De usu partium* 7.8 (3.541 K.); *De foetuum formatione* 6 (4.689 K.); *De differentiis pulsuum* 4.3 (8.721 K.); *De methodo medendi* 2.5 (10.107 K.); *De simplicium medicamentorum temperamentis ac facultatibus* 4.14 (11.664 K.); *In Hippocratis Epidemiarum librum VI commentarius* 4.10 (17B.161 K.) and 4.19 (17B.189 K.).

structures of the universe. So he can talk of a Peripatetic physiology, or a Stoic physiology, and contrast the physiology of Asclepiades, Erasistratus, Epicurus, and Thessalus with that of Hippocrates and even Moses.<sup>15</sup> This sort of physiology he regards at times as inessential or even irrelevant to medicine, or inappropriate to the discussion in hand, even praising Hippocrates for not going down the road of physiology that Plato followed in the *Timaeus*.<sup>16</sup> In *On the Properties of Simples*, for example, he rejects a detailed investigation into the physiology of drug action on the grounds that it would be time-consuming and possibly inconclusive compared with the rewards of experience.<sup>17</sup> 'Physiology' might in some circumstances be useful, but often all that it adds to experience is a confusion of terms.

This does not mean that Galen abandons this type of physiology entirely. He acknowledges its possible contribution towards a more precise, scientific demonstration, and he regards the notion that doctors should be banned from physiologising as an unjustified tyranny.<sup>18</sup> One can hardly imagine that he would have responded in the negative to the question he himself posed in his tract *Is Physiologia Necessary for Ethical Philosophy?*, especially as in both *On the Opinions of Hippocrates and Plato* and *On Problematical Movements* he was at pains to stress how a knowledge of the anatomy of the body contributed to an understanding of the workings of the soul or the brain.<sup>19</sup> There is a role for *physiologia*, and Galen does not deny it, but it is not central to his medicine. Should one wish to go further, then he affirms that the physiology of Hippocrates, with its elements, mixtures and humours, is far more satisfactory than that of the Stoics or the atomist universe of Asclepiades and the Methodists. This is

<sup>15</sup> Galenus, *De elementis secundum Hippocratem* 1.2 (1.449 K.); *De facultatibus naturalibus* 2.4 (2.88 and 2.92 K.); *De simpl. med. temp. ac fac.* 4.14 (11.664 K.) (Aristotle and Peripatetics); *De meth. med.* 1.2 (10.17 K.) (Stoics); *De elem. sec. Hipp.* 1.9 (1.486 K.); *De fac. nat.* 1.14 (2.45 K.) (Asclepiades); 2.4 (2.88–92 K.) (Erasistratus); *De meth. med.* 1.2 (10.17 K.) (Thessalus); *De elem. sec. Hipp.* 1.9 (1.486 K.); 10, 14, 17 K. (Hippocrates). Even Moses is credited with physiologising, and doing so in a better manner than Epicurus, *De usu part.* 11.14 (3.905 K.).

<sup>16</sup> Galen, *De elem. sec. Hipp.* 1.2 (1.449 K.); *Ad Thrasybulum, utrum medicinae an gymnastics hygieine* 30 (5.862 K.); *De placitis Hippocratis at Platonis* 9.9 (5.792 K.); *De meth. med.* 2.5 (10.107 K.); *De simpl. med. temp. ac fac.* 2.20 (11.517 K.) and 4.14 (11.664 K.); *In Hippocratis Epidemiarum librum I commentarius* 3.2 (17A.805 K.).

<sup>17</sup> Galen, *De simpl. med. temp. ac fac.* 2.1 (11.445 K.) and 4.4 (11.517 K.).

<sup>18</sup> Galen, *De causis pulsuum* 1.10 (9.86 K.) and 1.13 (9.89 K.); *De meth. med.* 2.5 (10.107 K.); *De simpl. med. temp. ac fac.* 2.20 (11.517 K.); *In Hipp. Epid. I comment.* 3.2 (17A.805 K.); *In Epid. VI comment.* 4.19 (17B.189–190 K.). Of course, the gap between Galen's rhetoric and his practice may vary considerably.

<sup>19</sup> For this now lost tract, see Galenus, *De libris propriis* 17 (19.48 K.). For *On Problematical Movements*, which survives only in Latin and Arabic versions, see my recent edition (Cambridge: 2011).



a lukewarm endorsement of physiology, compared with that of the two pseudo-Galenic authors, who both see it as an essential characteristic of medicine, and particularly, according to the author of the *Introduction to Medicine*, that of the rationalists and the followers of Hippocrates.

Galen's hesitant approval of the role of *physiologia* in medicine was, then, at least on a theoretical level, less enthusiastic than that of some other Hippocraticists, but that is less significant than the fact that his practice as described in his own writings could easily be viewed by outsiders as a typically Hippocratic 'physiological' exposition of the basic principles that govern the bodily universe. Galen frequently refers to mixtures, humours and so on to support conclusions reached by observation, experiment or logic, or, at the very least, to exclude ideas of others that he considered erroneous. Certainly by the late fifth century AD, the belief in a 'physiological part of medicine' was widespread in the Greek East, and in Latin authors depending on Greek sources – Stephanus of Alexandria, John of Alexandria, Palladius, Agnellus of Ravenna and pseudo-Soranus – as well as in the *Tabulae Alexandrinae* described by Owsei Temkin and, at greater length, by Beate Gundert.<sup>20</sup> Indeed, it would not be wrong to conclude that learned Greek medicine of the late fifth and sixth centuries took this classification almost for granted. Given Galen's hesitancy about physiologising, it is clear that we have here an example of Galenism as an evolving doctrine. Even if we do not posit any direct influence from the two pseudo-Galenic texts already noted, Galen's theories and comments in a variety of different places were now transformed in late-antique Galenism into something much more detailed and definite.<sup>21</sup>

What happens to this definition in the central Middle Ages in the West and in the Arab world is less clear. It was available in a variety of Latin

---

<sup>20</sup> Stephanus, *In Hippocratis Aphorismos commentarii* I.1: CMG XI.3.1.34; Johannes Alexandrinus, *In Hippocratis De natura pueri commentarium* 1: CMG XI.1.4.132; *Commentaria in librum De sectis Galeni* 1: 11 Pritchett; Agnellus Ravennas, *In Galeni De sectis commentarium* 5: 24 Westerink et alii; Palladius, *Scholia in Galeni De sectis* 75 Baffioni; [Soranus], *Quaestiones medicinales* 23; Temkin O., *The Double Face of Janus and Other Essays in the History of Medicine* (Baltimore: 1977) 189; Gundert B., "Die Tabulae Vindobonenses als Zeugnis alexandrinischer Lehrtätigkeit um 600 n. Chr.", in Fischer K.D. – Nickel D. – Potter P. – (eds.), *Text and Tradition. Studies in Ancient Medicine and its Transmission presented to Jutta Kollesch* (Leiden: 1998) 91–144. Note also that the reference to *to physiologikon* at Sor. *Gynaecia* 1.1.1, is taken over from an apparent quotation in the later *Commentaria in Aphorismos Hippocratis* of Theophilus.

<sup>21</sup> There is one caveat: the usual term is the physiological part of medicine, not physiology, although Galen does use *physiologia*, admittedly not in the context of the parts of medicine, and it would be relatively easy to consider the two terms as overlapping, and Soranus earlier uses 'the physiological' at *Gynaecia* 1.1.2, but 'physiology' in a similar context at 3.3.5.

translations of Greek works, preserved in a substantial number of codices from the pre-Salernitan period.<sup>22</sup> But how far, if at all, it penetrated into the Salernitan literature is not obvious, despite the growing tendency to use the word *physicus* to denote a learned medical practitioner.<sup>23</sup> Lexica of later medieval Latin cite the word *physiologus* and its cognates only in connection with natural science, not medicine. The word is absent from Petrus de Sancto Floro's medical lexicon, and, perhaps more tellingly, from the list of *quaestiones* of Pietro d'Abano and his school listed by Nancy Siraisi in her study of this late thirteenth-century scholar and his pupils.<sup>24</sup> Nor does it figure either in the *Isagoge* of Johannitius or in Avicenna's *Canon* I.1, two staples of late medieval medical education. Instead we find discussions in terms of the naturals, the non-naturals and the contra-naturals, and it is the naturals, i.e. the elements, complexions, the faculties, the bones and so on, that take the place of what earlier Galenists had termed 'the physiological part of medicine'.<sup>25</sup>

That is why in 1542, Jean Fernel, a leading member of the Paris medical faculty, entitled his study of the human body *De naturali parte medicinae*, to contrast it with works discussing diseases and their treatment.<sup>26</sup> Twelve years later he produced a revised version as part of a much larger work, his *Medicina*, in which this section receives a different title, *Physiologia*.<sup>27</sup> For this alleged innovation he has been awarded a place among the founding fathers of medicine. According to Chauncey D. Leake, he is 'the

<sup>22</sup> De Renzi Salvatore, *Collectio Salernitana* (Naples: 1852), vol. 1, 87–88. This corresponds closely to Stephanus Alexandrinus' *Commentarii in Hippocratis Aphorismos*, see Beccaria A., "Sulle tracce di un antico canone latino di Ippocrate e di Galeno, II: Gli Aforismi di Ippocrate nella versione e nei commenti del primo medioevo", *Italia medioevale e umanistica* 4 (1961) 35–41, who prints an edition of the text from four mss. Ihm S., *Clavis commentariorum der antiken medizinischen Texte* (Leiden: 2002) 172, lists many pre-twelfth-century mss.

<sup>23</sup> Bylebyl J.J., "The medical meaning of *Physica*", in McVaugh M.R. and Siraisi N.G. (eds.), *Renaissance Medical Learning. Evolution of a Tradition*, *Osiris*, n.s. 6 (1990) 16–41.

<sup>24</sup> Sancto Floro Petrus de, *Neue litterarische Beiträge zur mittelalterlichen Medizin*: ed. Pagel J.L. (Berlin: 1896); Siraisi N.G., *Taddeo Alderotti and his Pupils. Two Generations of Italian Medical Learning* (Princeton: 1981) 314–317, despite the numerous references to physiology in the index, 458.

<sup>25</sup> 'The natural' also retains the '*physis*' element in the Greek, and what is included under the heading of the naturals corresponds closely with *to physiologikon*, even if the non- and contra-naturals do not appear to have a direct Greek equivalent.

<sup>26</sup> Fernel Jean, *De naturali parte medicinae* (Paris: 1542). I cite it from the reprint (Lyons, J. Tornaesius and G. Gazeius: 1551).

<sup>27</sup> Fernel Jean, *Medicina* (Paris, A. Wechel: 1554). This revision is now available in English as *The Physiologia of Jean Fernel, 1567*, A. Wechel, *Translated and annotated by John M. Forrester* (Philadelphia: 2003), but not including the Dedication or the Preface of the 1554 edition.

first to speak of physiology in the modern period, coining the term to signify the branch of biological research in the modern sense of the word'.<sup>28</sup> Franklin, apparently applying the later title to the 1542 work, declares that Fernel wrote the first book devoted solely to physiology, and thus gave the discipline its name.<sup>29</sup> This seems a substantial honour for a title and a couple of sentences, for in reality what Fernel is doing is no more than recasting the first book of Avicenna's *Canon* in a neo-Galenist form, including exactly the same topics – elements, mixtures, humours, spirits, faculties and anatomy – but reverting to a purer Galenism and adopting a new vocabulary.<sup>30</sup> Fernel took his division of medicine from the two pseudo-Galenic tracts, both of which had been very familiar in Paris since 1528, when his colleague Guinther von Andernach turned them into Latin. Fernel's Latin mirrors that of Guinther, although his Greek terminology seems to be his own.<sup>31</sup> Indeed, in 1542 he openly acknowledges his debt to others, for in listing the five parts of medicine he declares that the part that investigates and searches out the nature of men 'they have called *phusiologikê*'.<sup>32</sup> The Latin form appears at the end of the preface to Book Two, when Fernel expresses the hope that by bringing together a comprehensive *physiologia* he might produce something useful, and that 'by way of demonstrating', we might achieve as complete a study of man as possible.<sup>33</sup> (The Latin is far from simple, and the text itself may be corrupt.) In 1554 Fernel produced a much clearer and briefer definition. Now *physiologikê* is 'that part of medicine which investigates the nature, powers and

<sup>28</sup> Leake C.D., *Some Founders of Physiology* (Washington, DC: 1956) 89; cf. Rothschuh, *Physiologie* 41–47.

<sup>29</sup> Franklin, *History* 4, although elsewhere he seems to be citing the heavily revised second edition, which he misdates (37) to 1544.

<sup>30</sup> That Fernel regarded *De naturali parte* and *physiologia* as identical is clear from the ending, where he has, in the first version, 655: 'His omnem iam videor hominis ortum atque adeo universam naturalem medicinae partem perstrinxisse, quae corporis humani dum integre sanum est constitutionem explicat'. This is changed in 1554, 250 = 601 tr. Forrester, to: 'His omnem iam videor hominis ortum atque adeo Physiologiam complexus quae hominis (dum prospere fruitur valetudine) constitutionem naturamque continet'. As noted, above, 'naturalis pars' is a respectable translation of the Greek.

<sup>31</sup> But Guinther kept the definitions in Greek in his version of the *Introductio*, and Sylvanius, whose version of the *Definitiones* became standard in successive Froben and Giuntine editions, misses out the relevant passage entirely.

<sup>32</sup> Fernel, *De naturali parte*, Pref. 11 'quae universam hominis naturam indagat ac perquirat φυσιολογική dixerunt'. For the revised formulation in the 1554 work, see below, note 34.

<sup>33</sup> Fernel, *De naturali parte* 190 'ut cum inventum id fuerit, hinc compositionis initium sumamus, simulque universam physiologiam contrahentes, quaecumque illa disputat gradatim ad unius hominis commoditatem et usum deducamus et naturalem de homine contemplationem demonstrandi via quoad eius fieri potest prosequimini'. The 1551 reprint reads 'minus hominis', but the 1547 Venice edition has 'unius'.

functions of the wholly healthy individual', and Fernel's aspiration is to bring together 'a comprehensive physiology that establishes the natural study of man by force of demonstration'.<sup>34</sup> The content of the work is revised, but there is no further discussion of physiology as such, and the word itself does not reappear until the index.<sup>35</sup> Fernel's book remains a classicising alternative to Avicenna's *Canon*, differing most obviously in its Latin style. It is not a novel approach to medicine, let alone a breakthrough in understanding the body, and one might note that the word was not coined by Fernel but could be found throughout the new Galenic Corpus. Nor, for nearly a century, was this section of Fernel's *Medicina* published separately as *Physiologia*.<sup>36</sup> It was, at best, one part of a much larger and more ambitious work.

Fernel almost certainly emphasised the word *Physiologia* in the title of his second edition (if indeed it was he and not his printer who decided on the title) in order to emphasise his Greekness, just as, half a century earlier, Antonio Benedetti had called his book on anatomy *Anatomicê* to stress its trendy Hellenism.<sup>37</sup> Fernel proclaims at one and the same time his individualism and his adherence to Greek doctrine by using a choice word, *physiologia*, and it is this apparent innovation that has gained Fernel the reputation as the founder of the discipline.<sup>38</sup>

Yet at the same time historians of physiology have murmured against Fernel's choice of topics that they consider alien to their subject. Franklin objects to his inclusion of mind, Loris Premuda to his inclusion of

<sup>34</sup> Fernel, *Medicina*, Pref. sig. \*vi recto 'φυσιολογική quae hominis integre sani naturam omnes illius vires functiones persequitur; 69 Sic universa contrahetur physiologia quae naturalem de homine contemplationem demonstrationis vi (via?) constituit'.

<sup>35</sup> For the change to the ending, see above, note 33. A further minor alteration occurs in the index, where, sig. z. ii recto, *physiologia* replaces an earlier *naturalis pars medicinae*, in both cases referring to the order of the bones.

<sup>36</sup> Sherrington gives no separate entry for *Physiologia* on its own, and it is clear that, unlike the *Pathologia*, it did not enjoy an independent existence. The first separate printing would appear to be *Les VII. Livres de la Physiologie traduit en français par Charles de Saint Germain* (Paris, J. Guignard: 1655), but the same firm brought out simultaneously French versions of the *Pathologie* and the *Thérapeutique*, and it may be more convenient to think of them as a triptych. If so, the first truly independent printing of the *Physiologia* is the revision of the 1655 French version by José Kany-Turpin, *La Physiologie* (Paris: 2001), and, in Latin and English, by John Forrester.

<sup>37</sup> Ferrari G., *L'esperienza del Passato. Alessandro Benedetti Filologo e Medico umanista* (Florence: 1996) 106–120.

<sup>38</sup> Note also that his five categories are given Greek names. In 1542, Pref., 11, as well as 'φυσιολογική', they are 'αἰτιολογική', 'σημειολογική', 'διαιτητική ἢ ὑγιαντική', and 'θεραπευτική'. The categories are slightly modified in 1554 (Guinther in his 1528 version had also retained the original, neither transcribing nor translating them.).

anatomical detail, which occupies almost a third of the book.<sup>39</sup> Both scholars forget that neither Fernel nor his successors saw any need to distinguish anatomy from physiology.<sup>40</sup> Indeed, even as more and more books came to be published bearing the title of physiology, particularly from the 1620s onwards, the anatomy of the body or of a particular organ remained an essential part of any such book.

To show this coexistence best, I give three early examples, two from France, and one from N. Germany. In 1543 Fernel's senior colleague, Jacobus Sylvius, brought out his introduction to anatomy as an appendix to his revision of an earlier translation of Galen's *De usu partium*. This was reissued in both Latin and French in 1555 with a new title, *In Hippocratis et Galeni physiologiae partem anatomicam isagoge* (*An Introduction to the Anatomical Part of the Physiology of Hippocrates and Galen*).<sup>41</sup> The immediate influence of Fernel is patent, as is Sylvius' assertion that anatomy forms one part of physiology. An even earlier follower of Fernel may have been the obscure Jean Lyège, Iohannes Lygaeus, who completed in early October 1554 his versification of Galenic anatomy, his *De humani corporis harmonia libri IIII* (*Four Books on the Harmony of the Human Body*).<sup>42</sup> His title page announces that it comes provided with discussions and notes for the benefit of students of *physiologia*, and the book opens with an address to the *Lector physiologus*. Whether by this he means a natural scientist or, perhaps more likely, a trendy anatomist is unclear.

My final example is somewhat later, a book that was published twice, under two different titles, and ascribed to two different authors. In 1576, Johannes Boeckel became the first professor of medicine at the new German university of Helmstedt. Formerly a student at Copenhagen and Wittenberg, Boeckel quickly set about making Helmstedt a modern medical school: he arranged for the building of a dissection hall on his own property, planted a botanical garden, and set up a hospital for sick students. He

<sup>39</sup> Franklin, *History* 37; Premuda L., *Storia della Fisiologia. Problemi e Figure* (Udine: 1965) 16. Franklin, *History* 37, merely says that he dealt at some length with human anatomy, 'which is to physiology as geography is to history'.

<sup>40</sup> Rothschild, *Physiologie* 41–47, rightly notes that Fernel was doing nothing new, and, earlier, 13, stresses that for Galen (and for Fernel) anatomy and physiology were not yet distinguished.

<sup>41</sup> Sylvius Jacobus, *In Hippocratis et Galeni physiologiae partem anatomicam Isagoge*, and *Introduction sur l'anatomique Partie de la Physiologie d'Hippocrate et Galien* (both Paris, J. Hulseau: 1555). The significance of this title was remarked on by Sherrington, *Fernel* 91.

<sup>42</sup> Lygaeus Johannes, *De humani corporis harmonia libri IIII* (Paris, M. Vascosan: 1555). The preface is dated 1 October, 1554, from Bar sur Aube. Lygaeus is likely to have studied with Fernel. His book, as an owner of the Wellcome copy (EPB 3918) remarks on the title page, is little more than a versification of Galen's *De usu partium*.

was himself interested in anatomy, lecturing regularly on the subject at the annual dissection of a male and a female corpse provided by the Duke of Brunswick.<sup>43</sup> Boeckel's long exposition of anatomy came out in 1585 under the title *Anatome, seu descriptio partium humani corporis* (*Anatomy, or a Description of the Parts of the Human Body*).<sup>44</sup> It was reprinted at Helmstedt in 1588, and again in 1589 at Wittenberg, as *Historia partium humani corporis*, so its interest was not entirely local. Boeckel's subtitle, announcing that the book represented what was done and taught each year at Helmstedt, may well be true, but it is also misleading. All but the first chapter is taken over word for word from a then-unpublished anatomy book written perhaps in 1559 by Jacob Bording, a fellow Fleming, who had been professor of medicine at the universities of Rostock and Copenhagen, where Boeckel had been his student.<sup>45</sup> This plagiarism angered Bording's successor at Rostock, Levinus Battus, another Fleming, who published his predecessor's original manuscript in 1591, publicly accusing Boeckel of theft. This time Bording's material bore a different title, *Physiologia*, and formed the first part of a volume that proclaimed that it too was the result of lectures, this time at Rostock and Copenhagen.<sup>46</sup> Obviously, Bording, who had died as long ago as 1560, could not be entirely responsible for the title, and so it must have been his editor or publisher who took the decision to disguise an aging discussion of anatomy under a new and fashionable title, *Physiologia*. The influence of Fernel is obvious, for Battus refers to *Physiologia* as one of the *tres partes medicinae*, using the same division that Fernel had used. I shall not go further into this N. German squabble, except to emphasise that the same book could be called both an anatomy and a physiology. Indeed, Boeckel's title and his introductory chapter indicate that for him and his audience the teaching of anatomy encompassed all that elsewhere Fernel had included in his *Physiologia*. Henceforth while some writers on anatomy avoided discussion of what

<sup>43</sup> Triebs M., *Die medizinische Fakultät der Universität Helmstedt (1576–1810)* (Wiesbaden: 1995) 45–46.

<sup>44</sup> Boeckel Johannes, *Anatome vel descriptio partium humani corporis ut ea in Academia Iulia quae est Helmstedt singulis annis publice praelegi, ac administrari solet* (Helmstedt, J. Lucius: 1585).

<sup>45</sup> Gysel C., "Jan Boekel (1535–1605) en zijn 'Anatome' (1585), een plagiaat van Bordings 'Physiologia' (1591)", *Acta Belgica Historiae Medicinae* 9 (1996) 21–27. On Bording, idem, "Jacobus Bordingus Antwerpiensis (1511–1560): Humanist en professor medicinae", *ibidem* 9 (1996) 2–11.

<sup>46</sup> I have not seen Bording's book, but take its title from the listing in the *Verzeichnis der im deutschen Sprachbereich erschienenen Drucke des XVI. Jahrhunderts*, B6703. *Physiologia, hygieine, pathologia. Prout has medicinae partes in inclutis Academiis Rostochiensi et Haffniensi publice enarrauit Jacobus Bording* (Rostock, S. Myliander: 1591).



we might term physiological topics, and vice versa, most writers continued to treat both together. Indeed, a cursory glance at the contents of treatises bearing these titles suggests that treatises on anatomy tend to abandon the study of the body's process in favour of descriptive anatomy more often than those dealing with physiology leave out the underlying anatomy of the body parts they study.<sup>47</sup> But the closer one comes to the nineteenth century, the more the functions of the body are explained in terms of physics, chemistry, or electricity, with the body's structures playing only a minor role.<sup>48</sup>

What's in a name? This exposition has tried to trace the evolution of the term *Physiology* from the Greeks to the Renaissance. It has tried to show how a term not greatly admired by Galen became a shibboleth of late-antique Galenism, and why modern historians' belief in Fernel as the founding father of physiology is optimistic, to say the least. If there are heroes in this story, they are two of my favourite authors, Pseudo-Galen and Anonymous. But this story still lacks an appropriate ending. As Franklin noted, it is hard to say when anatomy and physiology came definitely to be viewed as two separate subjects – perhaps only in the 1850s or even later – or when the study of physiology came to be defined solely as the investigation of the body's processes.<sup>49</sup> Discipline-formation among the sciences in the mid- and late nineteenth century may have played the major role, as Franklin suggested. But modern medical science no longer sees the need for a strict differentiation between the two. The Department of Anatomy at UCL, of which I was a member for over thirty years, has included among its major research interests, as well as the history of medicine, the brain and nervous function, developmental biology, and hard tissue, nails and bones, all topics which can be found in Fernel's *Physiologia* or, for that matter, in Avicenna's *Canon*. Modern medical science continues to transcend the boundaries cherished by historians.

---

<sup>47</sup> Anatomy continues to be covered in such a common textbook as Rivière Lazare, *Institutiones medicae* [...], *quibus totidem medicinae partes, physiologia, pathologia, semeiotice, hygieine et therapeutice dilucidè explicantur* (The Hague, Adriaan Vlacq: 1663). A later text combining old and new conceptions of physiology is Hamberger Georg Erhard, *Physiologia medica, seu de actionibus corporis humani sani coctrina principiis physicis a se editis, itemque mathematicis atque anatomicis superstructa* (Jena, T.W.E. Gyth: 1751).

<sup>48</sup> Two random examples: Frewen Thomas, *Physiologia. Or, the Doctrine of Nature, comprehended in the Origin and Progression of Human Life; the Vital and Animal Functions; Diseases of Body and Mind; and Remedies Prophylactic and Therapeutic* (London, J. Bew: 1780); Moran F., *Dissertatio inauguralis quaedam de physiologia ex effectibus electricitatis orientia complectens* (Edinburgh: 1820).

<sup>49</sup> See, for a more detailed examination, Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800. I, Old Physiology – The Pen", and "II, Old Anatomy – The Sword", *Studies in History and Philosophy of Biological and Biomedical Sciences*, 33 (2002) 631–665 and 34 (2003) 51–76.

### Selective bibliography

- ANASTASSIOU A. – IRMER D., *Testimonien zum Corpus Hippocraticum* (Göttingen: 1997–2006).
- BOECKEL JOHANNES, *Anatome vel descriptio partium humani corporis ut ea in Academia Iulia quae est Helmstedt singulis annis publice praelegi, ac administrari solet* (Helmstedt, J. Lucius: 1585).
- BORDING JACOB, *Physiologia, hygieine, pathologia. Prout has medicinae partes in inclytis Academiis Rostochiensi et Haffniensi publice enarrauit Jacobus Bording* (Rostock, S. Myliander: 1591).
- BYLEBYL J.J., “The Medical Meaning of *Physica*”, in McVaugh M.R. – Siraisi N.G. (eds.), *Renaissance Medical Learning. Evolution of a Tradition*, *Osiris*, n.s. 6 (1990) 16–41.
- CRAIK E.M., *Hippocrates, Places in Man* (Oxford: 1998).
- CUNNINGHAM A., “The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen”, *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- , “The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword”, *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.
- ENGLERT L., *Untersuchungen zu Galens Schrift Thrasybulos* (Leipzig: 1929).
- FERNEL JEAN, *De naturali parte medicinae* (Lyons, J. Tornaesius and G. Gazeius: 1551).
- , *Medicina* (Paris, A. Wechel: 1554).
- , *Physiologia*: tr. Forrester J.M. (2003), *The Physiologia of Jean Fernel (1567)*, Philadelphia.
- FERRARI G., *L’esperienza del Passato. Alessandro Benedetti Filologo e Medico umanista* (Florence: 1996).
- FIGARD L., *Un médecin philosophique au XVI<sup>e</sup> siècle* (Paris: 1903).
- FRANKLIN K.J., *A Short History of Physiology* (London-New York: 1949<sup>2</sup>).
- FREWEN THOMAS, *Physiologia. Or, the Doctrine of Nature, comprehended in the Origin and Progression of Human Life; the Vital and Animal Functions; Diseases of Body and Mind; and Remedies Prophylactic and Therapeutic* (London, J. Bew: 1780).
- FULTON J.F. – WILSON L.S., *Selected Readings in the History of Physiology* (Springfield, IL: 1966).
- GUNDELT B., “Die Tabulae Vindobonenses als Zeugnis alexandrinischer Lehrtätigkeit um 600 n. Chr.”, in Fischer K.D. – Nickel D. – Potter P. (eds.), *Text and Tradition. Studies in Ancient Medicine and its Transmission presented to Jutta Kollesch* (Leiden: 1998) 91–144.
- GYSEL C., “Jacobus Bordingus Antwerpiensis (1511–1560): Humanist en professor medicinae”, *Acta Belgica Historiae Medicinae* 9 (1996) 2–11.
- , “Jan Boekel (1535–1605) en zijn ‘Anatome’ (1585), een plagiaat van Bordings ‘Physiologia’ (1591)”, *Acta Belgica Historiae Medicinae* 9 (1996) 21–27.
- HALL T.S., *History of General Physiology 600 B.C. to A.D. 1900* (Chicago-London: 1975).
- KOLLESCH J., *Untersuchungen zu den pseudogalenischen Definitiones medicae* (Berlin: 1993).
- LEAKE C.D., *Some Founders of Physiology* (Washington DC: 1956).
- LYGAEUS JOHANNES, *De humani corporis harmonia libri IIII* (Paris, M. Vascosanus: 1555).
- MORAN FRANCIS, *Dissertatio inauguralis quaedam de physiologia ex effectibus electricitatis orientia complectens* (Edinburgh: 1820).
- NUTTON V., “The Fatal Embrace: Galen and the History of Medicine”, *Science in Context* 18 (2005) 111–121.
- PETIT C., (ed., trans.) *Galien. Tome III. Le Médecin. Introduction* (Paris: Les Belles Lettres, 2009).
- PREMUDA L., *Storia della Fisiologia. Problemi e Figure* (Udine: 1965).



- RENZI SALVATORE DE, *Collectio Salernitana*, I (Naples: 1852).
- ROTHSCHUH K., *History of Physiology* (Huntington, NY: 1973).
- , *Physiologie. Der Wandel ihrer Konzepte, Probleme und Methoden vom 16. bis 19. Jahrhundert* (Freiburg-Munich: 1968).
- SANCTO FLORO PETRUS DE, *Neue litterarische Beiträge zur mittelalterlichen Medicin*: ed. Pagel J.L. (Berlin: 1896).
- SHERRINGTON C., *The Endeavour of Jean Fernel* (Cambridge: 1945).
- SIRAISI N.G., *Taddeo Alderotti and his Pupils. Two Generations of Italian Medical Learning* (Princeton: 1981).
- SYLVIVS JACOBUS, *In Hippocratis et Galeni physiologiae partem anatomicam Isagoge* (Paris, J. Hulpeau: 1555).
- , *Introduction sur l'anatomique Partie de la Physiologie d'Hippocrate et Galien* (Paris, J. Hulpeau: 1555).
- TEMKIN O., *The Double Face of Janus and Other Essays in the History of Medicine* (Baltimore: 1977).
- TRIEBS M., *Die medizinische Fakultät der Universität Helmstedt (1576–1810)* (Wiesbaden: 1995).

# PHYSIOLOGICAL ANALOGIES AND METAPHORS IN EXPLANATIONS OF THE EARTH AND THE COSMOS

Liba Taub

## *Summary\**

This paper examines the use of analogies and metaphors drawn to physiological processes in order to explain meteorological phenomena and expound cosmological ideas, particularly as reflected in the writings of Aristotle, Epicurus and Lucretius. For these philosophical authors, the earth was not a living thing, yet the analogies and metaphors they used indicate that a consideration of living bodies, human and otherwise, could aid in understanding and explaining other natural, but inanimate, phenomena. That the earth was not a living being may have made the analogies and metaphors invoking physiological processes even more compelling: their power was achieved simultaneously both through novelty and intimate familiarity. A brief consideration of the use of similar analogies in seventeenth-century England is included.

## *Introduction*

References to the physiological processes experienced by living things, including plants and animals as well as humans, are found in the explanations offered by a number of ancient natural philosophers in their writings on other phenomena. So, for example, explanations of phenomena classified in Antiquity as meteorological, but today described as geological, often made reference to familiar bodily processes, particularly those associated with digestion. In some cases, it appears that the cosmos itself is described as a living organism, participating in various processes which today are understood as physiological.

---

\* I am grateful to Manfred Horstmanshoff, Helen King and Claus Zittel for inviting me to participate in the *Blood, Sweat and Tears* project, and for their helpful comments. I thank Andrew Cunningham, Aude Doody, Maija Kallinen, Vivian Nutton, Christine Salazar, Laurence Totelin, Frances Willmoth and an anonymous referee for their useful suggestions to an earlier draft. I am also grateful to Malcolm Wilson, who commented on an earlier draft and very generously shared portions of his unpublished work on Aristotle's meteorology. I appreciate the support provided by Newnham College for my research, and Emma Perkins' and Katharina Fischer's help in preparing this paper for publication.

In their Call for Papers for the present volume, the editors highlighted difficulties in applying the concept of physiology to ancient Greek and Roman medicine; for example, they noted that ‘where we would expect causality, we meet “only” with analogy’. Drawing attention to the situation in the Early Modern period, in which ancient explanations of physiological phenomena existed alongside newly emerging methods of explanation based on the study of nature, they drew attention to meteorology, geology and cosmology, as well as political and economic theory, as areas in which metaphors derived from physiology gained popularity.

What follows is an examination of the use of analogies drawn to physiological processes to explain meteorological phenomena and to expound cosmological ideas, primarily in the Greco-Roman world; I shall also refer briefly to the use of similar analogies in the Early Modern period. I will focus on explanation-building, and the relationship of analogies to observations, particularly in Aristotle, Epicurus and Lucretius, not least because these authors were important not only in Antiquity, but also in the Early Modern period.<sup>1</sup> Furthermore, both Aristotle and Epicurus commented on analogies and/or metaphors, giving possible insight into their own use of them. The relationship of analogies to metaphor will be addressed; generally, analogies point to resemblances, while metaphors may include novelty as an important feature. Recognising that none of the ancient authors under consideration thought that the earth or the cosmos itself is a living being, I will consider issues raised by references to the body and its associated physiological processes in analogies and metaphors intended to explain the natural world.

### *Analogy and metaphor*

Analogy has been recognised as pervasive in Greek natural philosophy, and it is worth considering the use of the terms *analogia* and *metaphora* by ancient authors. While the Greek word *analogia* (ἀναλογία can refer to ‘proportion’ (for example, 2 is to 4 as 4 is to 8) – in fact the mathematical meaning is the first one listed in the *Greek-English Lexicon* of Liddell, Scott and Jones (LSJ) – it can also mean ‘analogy’ in the sense of

---

<sup>1</sup> These authors are also the focus because of the relative abundance of evidence for their views. Because of limitations of space, other authors can only be mentioned very briefly here. This paper develops ideas I explored in Taub L., “Das Lebewesen und die Erde: Analogie oder Metapher in physikalischen Erklärungen der Antike?”, *Antike Naturwissenschaft und ihre Rezeption* 20 (Trier: 2010) 65–79.

‘pointing to a resemblance between relations in two different domains’.<sup>2</sup> Several ancient authors, including Aristotle and Epicurus, used the word *metaphora* (μεταφορά = English ‘metaphor’) to refer to the transference of a word to a new sense.<sup>3</sup> Put in modern terms, and borrowing from the philosopher of science Daniela Bailer-Jones, a metaphor ‘is a linguistic expression in which at least one part of the expression is transferred (*metapherein*; μεταφέρειν) from one domain of application where it is common, to another in which it is unusual’. While the relationship of analogy is often (perhaps even usually) an important factor which facilitates the understanding of a metaphor, it is not the case that analogy *necessarily* precedes the metaphor. Bailer-Jones suggests that it can be argued equally that the metaphor enables the recognition of an analogy.<sup>4</sup>

Metaphor has often been associated particularly with poetry, and is regarded by some literary theorists as a characteristic literary feature or trope. This association of metaphor with poetry may in fact go back at least to Aristotle, who discusses metaphor in his *Poetics* (1457b6–33) and also the *Rhetoric* (1410b12–15), as we will see. In some later traditions the use of metaphor has been regarded largely as a matter of decoration, intended to delight the hearer. Novelty or ‘freshness’ is often taken as a sign of metaphoricity.<sup>5</sup> But, for Aristotle and some other ancient authors, metaphor was not merely about poetical decoration; we will return to ancient views on the use of metaphor later, but first we need to consider the use of *analogia* in more detail.

As an example of an ancient author who uses the word *analogia* to mean ‘pointing to a resemblance between relations in two different domains’, in the first instance LSJ cites Aristotle’s *History of Animals* 486b19–22, quoted here:

There are some animals whose parts are neither identical in form nor differing in the way of excess or defect; but they are the same only in the way of analogy, as, for instance, bone is only analogous to fish-bone, nail to hoof,

---

<sup>2</sup> Liddell H.G. – Scott R. – Jones H.S. et alii, *A Greek-English Lexicon* (Oxford: 1968) 111; hereafter referred to as ‘LSJ’; Bailer-Jones D.M., “Models, Metaphors and Analogies”, in Machamer P. – Silberstein M. (eds.), *The Blackwell Guide to the Philosophy of Science* (Malden, Mass.-Oxford: 2002) 110.

<sup>3</sup> For example, LSJ 1118 cites Aristoteles, *Poetica* 1457b6; *Rhetorica* 1410b36; Epicurus, *De rerum natura* 28.5.

<sup>4</sup> Bailer-Jones, “Models, Metaphors and Analogies” 114.

<sup>5</sup> Bailer-Jones, “Models, Metaphors and Analogies” 115. Metaphorical language is often contrasted with literal language, but Bailer-Jones argues against a clear-cut distinction here; rather, she maintains that there are ‘degrees’ of metaphoricity.

hand to claw, and scale to feather; for what the feather is in a bird, the scale is in a fish.<sup>6</sup>

The focus on anatomy in this use of the word *analogia* offers a vivid and easily comprehensible picture.<sup>7</sup>

### *Aristotle on analogy and metaphor*

The use of analogies in Greek philosophy has been explored by a number of scholars, including Geoffrey Lloyd; indeed, as Lloyd argues, analogical argument, or thinking by analogy, is sometimes pointed to as a hallmark of the ‘scientific method’ of the ancient Greeks.<sup>8</sup> In the *Posterior Analytics*, in which he discusses demonstrative science, and what are often understood as his views on ‘scientific method’, Aristotle makes direct reference several times, very briefly, to the use of analogy.<sup>9</sup> At 76a37–40 he states:

Of the things they use in the demonstrative sciences some are proper to each science others common – but common by analogy, since things are *useful* in so far as they bear on the kind [genus] under the science.<sup>10</sup>

<sup>6</sup> “Ἐνια δὲ τῶν ζώων οὔτε εἶδει τὰ μόρια ταῦτ’ ἔχει οὔτε καθ’ ὑπεροχὴν καὶ ἔλλειψιν, ἀλλὰ κατ’ ἀναλογίαν, οἷον πέπονθεν ὅστούν πρὸς ἀκανθαν καὶ ὄνυξ πρὸς ὀπλὴν καὶ χεῖρ πρὸς χηλὴν καὶ πρὸς πτερόν λεπίς· ὁ γὰρ ἐν ὄρνιθι πτερόν, τοῦτο ἐν τῷ ἰχθύϊ ἐστὶ λεπίς”. Tr. Thompson D’A.W. (1984) 775.

<sup>7</sup> These analogies suggest a similarity of function. Freudenthal G., *Aristotle’s Theory of Material Substance. Heat and Pneuma, Form and Soul* (Oxford: 1995) 117 n. 27 briefly mentions Aristotle’s notion of analogy as functional equivalence; cf., for example, Aristoteles, *De partibus animalium* 1.4 (644a16–23); see also Balme D.M., *Aristotle’s De Partibus Animalium I and De Generatione Animalium I* (Oxford: 1972) 120, 148, and Wilson M., *Aristotle’s Theory of the Unity of Science* (Toronto: 2000) 10–11. Questions relating to whether functional equivalence has teleological (or non-teleological) force are outside the scope of this paper. On analogy more generally in Aristotle’s writings on animals, see Wilson *Aristotle’s Theory* ch. 2 (‘Analogy in Aristotle’s Biology’). As Sedley D., “Lucretius and the New Empedocles”, *Leeds International Classical Studies* 2, 4 (2003) 9 has noted, Empedocles (B82) proposed a functional equivalence between hair, leaves, feathers and scales. From our modern perspective it may seem familiar and not entirely surprising; this type of analogy is not entirely unlike the modern notion of homology used to relate the parts of different species.

<sup>8</sup> See, for example, Lloyd G.E.R., *Polarity and Analogy. Two Types of Argumentation in Early Greek Thought* (Cambridge: 1966); Garani M., *Empedocles redivivus: Poetry and Analogy in Lucretius* (London: 2007) 18–25.

<sup>9</sup> The difficulties of relating the scientific method prescribed in the *Posterior Analytics* to Aristotle’s own scientific writings have been the focus of much scholarly debate; see Barnes J., “Aristotle’s Theory of Demonstration”, *Phronesis* 14, 2 (1969) 123–152.

<sup>10</sup> “Ἔστι δ’ ὡν χρῶνται ἐν ταῖς ἀποδευκτικαῖς ἐπιστήμαις τὰ μὲν ἴδια ἐκάστης ἐπιστήμης τὰ δὲ κοινά, κοινὰ δὲ κατ’ ἀναλογίαν, ἐπεὶ χρήσιμόν γε ὅσον ἐν τῷ ὑπὸ τὴν ἐπιστήμην γένει”. Tr. Barnes (1975) 16. See also Arist. *Analytica posteriora* 98a20–23 (2.14) and 99a15–16 (2.17).

He elaborates:

Proper: e.g. that a line is *such and such*, and straight so and so; common: e.g. that if equals are taken from equals, the remainders are equal. But each of these is sufficient in so far as it bears on the genus; for it will produce the same result even if it is not assumed as holding of everything but only for the case of magnitudes – or, for the arithmetician, for numbers.<sup>11</sup>

While this discussion of the use of analogy relates to geometry and arithmetic, the *Posterior Analytics* was not meant to be applicable only to the mathematical sciences. Indeed, as Jonathan Barnes noted, ‘analogies are a profound feature of Aristotle’s biology’; Malcolm Wilson has pointed out that Aristotle uses the concept, and term, ‘analogy’ most frequently and systematically in his biological works.<sup>12</sup> It is with this in mind that we should understand the citation in LSJ of the passage from the *History of Animals* quoted above, as a key example of the use of the term ‘analogy’: analogies play a prominent role in Aristotle’s biological works.

In his *Poetics* (1457b7–16 and 20–22), Aristotle defined metaphor as the application of an alien name by transference either from genus to species, or from species to genus, or from species to species, or by analogy, that is, proportion.<sup>13</sup> The examples offered for the type ‘from analogy’ are most like modern metaphors; here, quoting Aristotle: ‘metaphor by analogy means this: when B is to A as D is to C, then instead of B the poet will say D and B instead of D [...] For instance, a cup is to Dionysus what a shield is to Ares; so he will call the cup “Dionysus’s shield” and the shield “Ares’ cup.”’<sup>14</sup>

<sup>11</sup> ἴδια μὲν οἷον γραμμὴν εἶναι τοιανδί καὶ τὸ εὐθύ, κοινὰ δὲ οἷον τὸ ἴσα ἀπὸ ἴσων ἂν ἀφέλῃ, ὅτι ἴσα τὰ λοιπά. ἱκανὸν δ’ ἕκαστον τούτων ὅσον ἐν τῷ γένει· ταῦτό γὰρ ποιήσῃ, κἂν μὴ κατὰ πάντων λάβῃ ἄλλ’ ἐπὶ μεγεθῶν μόνον, τῷ δ’ ἀριθμητικῷ ἐπ’ ἀριθμῶν. Tr. Barnes (1984) 124.

<sup>12</sup> Barnes (1975) 240 (note to 98a20); Wilson, *Aristotle’s Theory* 53. Wilson devotes ch. 2 of his book to analogy in Aristotle’s biology; analogy and demonstration are treated in ch. 3. On the use of the term ‘biology’ with reference to Aristotle’s writings, see Cunningham A., “Aristotle’s Animal Books: Ethology, Biology, Anatomy, or Philosophy?”, *Philosophical Topics* 27, 1 (Spring 1999) 17–41.

<sup>13</sup> ‘μεταφορὰ δὲ ἐστὶν οὐνόματος ἀλλοτρίου ἐπιφορὰ ἢ ἀπὸ τοῦ γένους ἐπὶ εἶδος ἢ ἀπὸ τοῦ εἶδους ἐπὶ τὸ γένος ἢ ἀπὸ τοῦ εἶδους ἐπὶ εἶδος ἢ κατὰ τὸ ἀνάλογον’. Following this, Aristotle then gave examples of these four types. Most of the examples he offers for the first three would now be understood not as metaphors, but as examples of metonymy or synecdoche. See Rapp C., “Aristotle’s Rhetoric”, *The Stanford Encyclopedia of Philosophy* (Winter 2008 Edition); Zalta Edward N. (ed.), URL = <http://plato.stanford.edu/archives/win2008/entries/aristotle-rhetoric/>, section 8.2 (“Aristotelian Metaphors”).

<sup>14</sup> ‘τὸ δὲ ἀνάλογον λέγω, ὅταν ὁμοίως ἔχῃ τὸ δεύτερον πρὸς τὸ πρῶτον καὶ τὸ τέταρτον πρὸς τὸ τρίτον: ἐρεῖ γὰρ ἀντὶ τοῦ δευτέρου τὸ τέταρτον ἢ ἀντὶ τοῦ τετάρτου τὸ δεύτερον. καὶ ἐνίοτε προστιθέασιν ἀνθ’ οὗ λέγει πρὸς ὃ ἐστὶ. λέγω δὲ οἷον ὁμοίως ἔχει φιάλη πρὸς Διόνυσον καὶ ἀσπίς πρὸς Ἀρη: ἐρεῖ τοίνυν τὴν φιάλην ἀσπίδα Διονύσου καὶ τὴν ἀσπίδα φιάλην Ἀρεως’. Aristotle

Aristotle emphasises the *cognitive* function of metaphors; in the *Rhetoric* (1410b12–15), he explains that metaphors bring about learning. To understand a metaphor, the hearer must find something in common between the metaphor and the thing to which it refers.<sup>15</sup> Aristotle notes that ‘when the poet calls old age ‘a withered stalk’, he conveys a new idea, a new fact, to us by means of the general notion of ‘lost bloom’, which is common to both things’. Aristotle’s treatment of metaphor occurs within a broader discussion of how we learn; he explains that ‘we all naturally find it agreeable to get hold of new ideas easily: words express ideas, and therefore those words are the most agreeable that enable us to get hold of new ideas. Now strange words simply puzzle us; ordinary words convey only what we know already; it is from metaphor that we can best get hold of something fresh’.<sup>16</sup>

### *Epicurus’ use of analogy*

Epicurus was another ancient philosopher concerned with the use of language and metaphor. He advocates the use of ‘ordinary language’ in philosophical discourse, but acknowledges that metaphorical uses of words are sometimes inevitable. He cautions that care must be taken lest such metaphorical uses obscure philosophical concepts.<sup>17</sup> (In his *Letter to Herodotus* 37–38, he stated that ‘[...] the primary signification of every term employed must be clearly seen, and ought to need no proving’).

---

himself regards the metaphors of this group, which are built from analogy, as the most important type of enthymemes. In his *Rhetoric*, an enthymeme was defined as a ‘rhetorical syllogism’ which was based on probable opinions, thus distinguishing it from a scientific (demonstrative) syllogism. It aimed at persuasion whilst scientific syllogism aimed at demonstration. See Rapp, “Aristotle’s *Rhetoric*”, section 6 (The Enthymeme).

<sup>15</sup> See Rapp, “Aristotle’s *Rhetoric*” section 8.2 (“Aristotelian Metaphors”). As he explains: ‘Metaphors are closely related to similes; but as opposed to the later tradition, Aristotle does not define the metaphor as an abbreviated simile, but, the other way around, the simile as a metaphor. The simile differs from the metaphor in the form of expression: while in the metaphor something is identified or substituted, the simile compares two things with each other, using words as “like”, “as” etc. For example, “He rushed as a lion”, is, according to Aristotle, a simile, but “The lion rushed” is a metaphor’.

<sup>16</sup> ‘εἰπωμεν οὖν καὶ διαριθμησώμεθα: ἀρχὴ δ’ ἔστω ἡμῖν αὕτη. τὸ γὰρ μανθάνειν ῥαδίως ἢ δὴ φύσει πᾶσιν ἐστὶ, τὰ δὲ ὀνόματα σημαίνει τι, ὥστε ὅσα τῶν ὀνομάτων ποιεῖ ἡμῖν μάθησιν, ἤδη διστά. αἱ μὲν οὖν γλῶτται ἀγνώτες, τὰ δὲ κύρια ἴσμεν: ἢ δὲ μεταφορὰ ποιεῖ τοῦτο μάλιστα’. Tr. Roberts W. R. (1984) 2250.

<sup>17</sup> Garani, *Empedocles redivivus* 152–153. See also Sedley D., “Epicurus on Nature Book XXVIII”, *Cronache ercolanesi* 3 (1973) 21–23, and his reading of Epicurus’s *On Nature*.



Analogy played an important role in Epicurus' philosophy, and numerous examples are found in his natural philosophical letters. Significantly, for Epicurus analogy is one of the principal ways in which we come to have thoughts. He emphasised that the study of nature requires a method of inquiry; he set out his method, or *kanôn*, in a work which is no longer extant, but which is summarised by Diogenes Laertius, in his *Lives of Eminent Philosophers*. Intriguingly, the title of the work, *Kanôn*, may be understood as referring, metaphorically, to a ruler or standard of measurement; Epicurus' *Kanôn* described the standards used to guide natural philosophical investigations.<sup>18</sup> Elizabeth Asmis has emphasised that Diogenes Laertius' explanation of Epicurus' canonic should not take precedence over Epicurus' own discussion in his *Letter to Herodotus*.<sup>19</sup> Nevertheless, Diogenes Laertius' summary indicates the important role of analogy, as one of the principal ways in which we think 'all thoughts come to be from the perceptions by incidence, analogy, similarity, and combination, with some contribution by calculation'.<sup>20</sup> For Epicurus, the use of analogy allows us to extend knowledge from what is perceived to that which cannot be perceived. So, for example, in the *Letter to Herodotus* (58–59), the use of analogy is key to how we can understand the atom, as direct observation is impossible; the word *analogia* is specifically used there by Epicurus.<sup>21</sup> In the *Letter to Pythocles*, many analogies are offered to understand celestial and meteorological phenomena, even when the term *analogia* is not used; some of these will be considered in more detail below.

With this brief consideration of Aristotle's and Epicurus' views on analogy and metaphor in mind, let us now examine some examples of analogy and metaphor in their discussions of meteorological phenomena. There are very few surviving Greco-Roman works devoted to the study of such phenomena, and Aristotle's *Meteorology* is the earliest.

<sup>18</sup> Asmis E., *Epicurus' Scientific Method* (Ithaca: 1984) 19.

<sup>19</sup> Asmis, *Epicurus' Scientific Method* 23–24.

<sup>20</sup> Asmis, *Epicurus' Scientific Method* 65–66.

<sup>21</sup> See Asmis, *Epicurus' Scientific Method* 177, where other terminology associated with *analogia* is also discussed. See also Inwood B., "The Origin of Epicurus' Concept of Void", *Classical Philology* 76, 4 (1981) 273–285; Rist J.M., *Epicurus. Introduction* (Cambridge: 1972) 35, 55 and *passim*.

*Analogy in Aristotle's Meteorology*

One of the questions implicit in a consideration of Aristotle's *Meteorology* is the extent to which the cosmos as a whole may be regarded as being like a living thing. It is important to stress that while Aristotle repeatedly points to analogies to living bodies, he does not seem to think of the cosmos itself as an animal, or living being.<sup>22</sup> Nevertheless, the use of analogies to living things and their bodily processes plays an important role, particularly in his discussion of the exhalations central to his meteorological theories; the analogies to living beings and the processes they experience link meteorology quite literally to the earth and help, for example, to explain seismological activity. In particular, digestive analogies are used with regard to earthquakes and the sea.<sup>23</sup>

As one example, in his explanation of earthquakes offered in the *Meteorology*, Aristotle draws an extended analogy between exhalations trapped in the earth and wind trapped in the human body. To begin with, both can cause movements: 'we must suppose that the wind in the earth has effects similar to those of the wind in our bodies whose force when it is pent up inside us can cause tremors and throbbings, some earthquakes being like a tremor, some like a throbbing'.<sup>24</sup> He adds: 'We must suppose, again, that the earth is affected as we often are after making water, when a sort of tremor runs through the body as a body of wind turns inwards again from without. For the force that wind has can be seen not only by studying its effects in the air, when one would expect it to be able to produce them because of its volume, but also in the bodies of living things'. He elaborates: 'Tetanus and spasms are movements caused by wind, and are so strong that the combined strength and efforts of a number of men is unable to master the movements of their victims. And if we may com-

---

<sup>22</sup> See Matthen M., "The Holistic Presuppositions of Aristotle's Cosmology", *Oxford Studies in Ancient Philosophy* 20 (2001) 171–199.

<sup>23</sup> A consideration of the use of other (non-physiological) analogies by Aristotle is outside the scope of this study.

<sup>24</sup> Aristoteles, *Meteorologica* 366b14–19 'δεῖ γὰρ νοεῖν ὅτι ὥσπερ ἐν τῷ σώματι ἡμῶν καὶ τρόμων καὶ σφυγμῶν αἰτίον ἐστὶν ἢ τοῦ πνεύματος ἐναπολαμβανομένη δύναμις, οὕτω καὶ ἐν τῇ γῇ τὸ πνεῦμα παραπλήσιον ποιεῖν, καὶ τὸν μὲν τῶν σεισμῶν οἷον τρόμον εἶναι τὸν δ' οἷον σφυγμόν, καὶ καθάπερ συμβαίνει πολλάκις μετὰ τὴν οὕρησιν (διὰ τοῦ σώματος γὰρ γίγνεται ὥσπερ τρόμος τις ἀντιμετισταμένου τοῦ πνεύματος ἐξῶθεν εἰσω ἄθροου), τοιαῦτα [γὰρ] γίγνεσθαι καὶ περὶ τὴν γῆν'. Tr. Lee H.D.P. (1952) 209.

pare great things with small, we must suppose that the same sort of thing happens to the earth'.<sup>25</sup>

Aristotle explains that just as the causes of earthquakes can be understood as analogous with bodily processes, so can the saltiness of the sea, which is due to the dry exhalation.<sup>26</sup> In living bodies, the residues produced are salty and bitter; urine and sweat are the examples given. The dry exhalation is, Aristotle explains, a residue of natural growth and generation, and so it is salty. The dry (salty) exhalation is mixed with the moist and vaporous exhalation, condenses into clouds and falls as rain. In this way, the sea contains salt, as a residue from the dry exhalation.<sup>27</sup> The idea that the dry exhalation contains residues from generation and growth reinforces analogies drawn in several of his writings, between the earth and the means of nourishment in plants and animals.

While Aristotle used analogies to human physiological processes, including the excretion of urine and sweat, to explain meteorological phenomena, he rejected what he regarded as the use of 'merely' poetic metaphors to describe such phenomena. In his discussion of the sea's salinity, he criticises the view of Democritus (that the sea's volume is diminishing, and that it will eventually disappear) as being like something out of Aesop's fables (356b9–12). He regards it as laughable to think that Empedocles 'has made an intelligible statement when he says that the sea is the sweat of the earth'. Rather, he objects that 'such a statement is perhaps satisfactory in poetry, for metaphor is a poetic device, but it does not advance our knowledge of nature' (357a24–28).<sup>28</sup> Aristotle demands a

<sup>25</sup> Arist. *Mete.* 2, 366b19–30 'ὅσῃν δ' ἔχει τὸ πνεῦμα δύναμιν, οὐ μόνον ἐκ τῶν ἐν τῷ ἀέρι δεῖ θεωρεῖν γιγνομένων (ἐνταῦθα μὲν γὰρ διὰ τὸ μέγεθος ὑπολάβοι τις ἂν τοιαῦτα δύνασθαι ποιεῖν) ἀλλὰ καὶ ἐν τοῖς σώμασι τοῖς τῶν ζώων· οἳ τε γὰρ τέτανοι καὶ οἱ σπασμοὶ πνεύματος μὲν εἰσιν κινήσεις, τοσαύτην δὲ ἔχουσιν ἰσχὺν ὥστε πολλοὺς ἅμα πειρωμένους ἀποβιάζεσθαι μὴ δύνασθαι κρατεῖν τῆς κινήσεως τῶν ἀρρωστούντων. τοιοῦτον δὲ δεῖ νοεῖν τὸ γιγνόμενον καὶ ἐν τῇ γῇ, ὡς εἰκάσαι πρὸς μικρὸν μείζον'. Tr. Lee 209–211. In his discussion of the causes of earthquakes and the views of various natural philosophers (*Natural Questions*, Book VI), Seneca also points to analogies between the earth and living bodies; see, for example, 6.14.122. See also Taub L., *Ancient Meteorology* (London: 2003) 151–152.

<sup>26</sup> Wilson M., *A More Disorderly Nature*, usefully points to the prevalence of digestive analogies in Aristotle's discussions of earthquakes and the sea. I am grateful to him for sharing his unpublished work, in which he discusses meteorological phenomena and Aristotle's explanations of their causes in greater detail than is possible here.

<sup>27</sup> Arist. *Mete.* 357b24–26; 358a3–25. See also Hankinson R.J., "Science", in Barnes J. (ed.), *The Cambridge Companion to Aristotle* (Cambridge: 1995) 157.

<sup>28</sup> 'ὁμοίως δὲ γελοῖον καὶ εἰ τις εἰπὼν ἰδρώτα τῆς γῆς εἶναι τὴν θάλατταν οἶεται τι σαφές εἶρηκεναι, καθάπερ Ἐμπεδοκλῆς. πρὸς ποίησιν μὲν γὰρ οὕτως εἰπὼν ἴσως εἴρηκεν ἱκανῶς (ἢ γὰρ μεταφορὰ ποιητικόν), πρὸς δὲ τὸ γνῶναι τὴν φύσιν οὐχ ἱκανῶς'. Tr. Lee 149.

comprehensive explanation, in which causes are addressed; rejecting the fable-like and poetic descriptions of predecessors, he offers his own, based on his theory relating to two exhalations (357b21–26).

Aristotle explained that the exhalations arise when the earth is heated by the Sun; a more vaporous exhalation comes from the moisture in and on the earth, and a dry exhalation from the earth itself.<sup>29</sup> The dry exhalation is hot and easily flammable. Above the surface of the earth it produces winds, comets, thunder and lightning. Its motion under the surface of the earth gives rise to geological phenomena like earthquakes. Aristotle also explains that ‘the sun not only draws up the moisture on the earth’s surface but also heats and so dries the earth itself’.<sup>30</sup> The dry exhalation apparently also heats the interior of the earth. Aristotle may have thought of the hot exhalation circulating in the bowels of the earth as supplying the heat which allows the earth to function as a surrogate stomach.

Without using the term *analogia*, Aristotle presents his explanation of the saltiness of the sea, which relies on an extended analogy to physiological, specifically digestive, processes (357b24–358a26). He states that there is a salty and bitter residue of some food processed by living bodies which is the least digested matter; he suggests that something similar happens in the world more generally. In his view, the exhalation on dry land is a similar residue, analogous to that produced through the digestive processes. Here, the explanation of the salinity of the sea involves both the two-exhalation theory and an analogy to digestion. After the dry land produces its exhalation, the residue is mixed with the moist and vaporous exhalation, which then condenses in clouds and is carried down as rain, which – containing the dry residue, or salt – ends up in the sea.

An analogy between the earth and the digestive parts of animals is explicitly presented in the *Parts of Animals*. Here Aristotle explains that ‘plants get their food from the earth by means of their roots; and this food is already elaborated when taken in, which is the reason why plants produce no excrement, the earth and its heat serving them just as [ὥσπερ] a belly’. He suggests that the belly of animals is an ‘internal substitute for the earth’.<sup>31</sup> In *On Youth, Old Age, Life and Death, and Respiration* 1

<sup>29</sup> Arist. *Mete.* 341b6–10.

<sup>30</sup> Arist. *Mete.* 360a6–8. Tr. Lee 165.

<sup>31</sup> Arist. *PA* 2.3 (650a21–25) ‘Τὰ μὲν γὰρ φυτὰ λαμβάνει τὴν τροφὴν κατειργασμένην ἐκ τῆς γῆς ταῖς ῥίζαις (διὸ καὶ περίττωμα οὐ γίνεται τοῖς φυτοῖς· τῇ γὰρ γῇ καὶ τῇ ἐν αὐτῇ θερμότητι χρῆται ὥσπερ κοιλία), τὰ δὲ ζῶα πάντα μὲν σχεδόν, τὰ δὲ πορευτικά φανερώς, οἷον γῆν ἐν αὐτοῖς

(468a9–12) Aristotle draws an analogy between plant and animal digestion, stating that ‘there is a correspondence between the roots in a plant and what is called the mouth in animals, by means of which they take in their food, some from the earth, some by their own efforts’.<sup>32</sup> According to Aristotle, exhalations and heat arise when food is being digested,<sup>33</sup> just as exhalations and heat come from the earth when it is heated by the warmth of the Sun. Here we might compare also the Hippocratic *Humours* 11, which states that ‘just as earth is to trees, so is the stomach to animals’.<sup>34</sup> Both the mouth and stomach are required for nutrition and digestion to occur in animals.

In *On Youth, Old Age, Life and Death, and Respiration* Aristotle emphasises that the retention of heat by animals and plants is crucial, because ‘everything living has soul, and it, as we have said, cannot exist without the presence of natural heat’. In plants, the natural heat is sustained both through nourishment (from the earth) and through the surrounding air. He explains the effects of changes in air temperature on plants by drawing an analogy with the ingestion of food by humans, which cools their bodies:

For the food has a cooling effect when it enters (as it does for men immediately after a meal), whereas abstinence from food produces heat and thirst. The air, if it be motionless, becomes hot, but by the entry of food a motion is set up which lasts until digestion is completed and so cools it. If the surrounding air is excessively cold owing to the time of year, there being severe frost, the force of the heat dwindles; but when there are hot spells and the moisture drawn from the ground cannot produce its cooling effect, the heat comes to an end by exhaustion. Trees suffering at such seasons are said to be blighted or star-stricken. Hence the practice of laying beneath the roots

---

ἔχει τὸ τῆς κοιλίας κύτος, ἐξ ἧς, ὥσπερ ἐκεῖνα ταῖς ῥίζαις, ταῦτα δεῖ τινι τὴν τροφήν λαμβάνειν, ἕως τὸ τῆς ἐχομένης πέψεως λάβῃ τέλος’. Tr. Ogle W. (*Complete Works*), vol. 1, 1012; cf. 4.4 (678a13), slightly modified. See also Freudenthal, *Aristotle’s Theory of Material Substance* 71–73. At several points in the *Meteorology* Aristotle refers to the internal heat of the earth. Freudenthal 72 suggests that Aristotle’s ‘occasional allusions to an analogy between the living animal body and the earth (e.g. *Mete.* 1.14, 351a26–27) may be taken to lend some support’ to the idea that the earth inherently possesses ‘primeval’ heat: ‘Aristotle may have thought that the earth possesses an internal source of heat, in analogy with the heart, the source of vital heat in sanguineous animals’. See also Taub, *Ancient Meteorology* 99–100.

<sup>32</sup> ‘ἀνάλογον γάρ εἰσιν αἱ ῥίζαι τοῖς φυτοῖς καὶ τὸ καλούμενον στόμα τοῖς ζώοις, δι’ οὗ τὴν τροφήν τὰ μὲν ἐκ τῆς γῆς λαμβάνει, τὰ δὲ δι’ αὐτῶν’. Tr. Ross G.R.T. (*Complete Works*), vol. 1, 746.

<sup>33</sup> Arist. *PA* 672b14–19.

<sup>34</sup> Hippocrates, *De humoribus* 11.1 (5.490 L.) “Ὡσπερ τοῖσι δένδρεσιν ἡ γῆ οὕτω τοῖσι ζώοισιν ἡ γαστήρ’.

stones of certain species or water in pots, for the purpose of cooling the roots of the plants.<sup>35</sup>

These analogies between the earth and various types of living things, especially in relation to nourishment and digestion, are powerfully drawn and evocative. They serve to emphasise the links between natural phenomena (including earthquakes and winds) and living things, and play an important role in underpinning Aristotle's meteorological views.

Yet in spite of his frequent use of analogies, Aristotle – perhaps surprisingly – does not examine their logical character.<sup>36</sup> He offered no analysis of the use of analogy; he seems simply to take for granted the usefulness of analogies in helping to locate causes, that is, to develop and offer an explanation of phenomena. At one point in the *Metaphysics* 1048a35–37, he even suggests that in some cases an analogy will offer our best, and only, way of understanding: 'we must not seek a definition of everything but be content to grasp the analogy'.<sup>37</sup> Aristotle employs analogies from everyday experience not as part of a demonstration or proof, but rather to make the explanation comprehensible.<sup>38</sup>

The references to the body and bodily processes, notably digestion, and comparisons such as the salty residue produced in dry exhalation with sweat and urine, would have provided homely and familiar examples.<sup>39</sup> The use of everyday examples provides, by analogy, an empirical basis for Aristotle's explanations of phenomena which are too distant or difficult to be investigated directly. That certain features of meteorological theory may be readily comprehensible through the use of analogy is reinforced

<sup>35</sup> Aristoteles, *De iuventute* 470a23–b5 'καὶ γὰρ ἡ τροφή ποιεῖ κατὰψυξιν εἰσιούσα, καθάπερ καὶ τοῖς ἀνθρώποις τὸ πρῶτον προσενεγκαμένοις, αἱ δὲ νηστεῖαι θερμαίνουσι καὶ δίψας ποιοῦσιν· ἀκίνητος γὰρ ὢν ὁ ἀὴρ αἰεὶ θερμαίνεται, τῆς δὲ τροφῆς εἰσιούσης καταψύχεται κινούμενος, ἕως ἂν λάβῃ τὴν πέψιν. ἐὰν δὲ τὸ περιέχον ὑπερβάλλῃ ψυχρότητι διὰ τὴν ὥραν, ἰσχυρῶν γινομένων πάγῳ, ἐξαυαίνεται ἡ τοῦ θερμοῦ ἰσχύς, ἂν δὲ συμβαίῃ καύματα καὶ μὴ δύνηται τὸ σπώμενον ἐκ τῆς γῆς ὑγρὸν καταψύχειν, φθείρεται μαραινόμενον τὸ θερμόν, καὶ λέγεται σφακελίζειν καὶ ἀστροβλῆτα γίνεσθαι τὰ δένδρα περὶ τοὺς καιροὺς τούτους. διὸ καὶ γένη τινὰ λίθων ταῖς ῥίζαις ὑποβάλλουσι καὶ ὕδωρ ἐν ἀγγείῃς, ὅπως αἱ ῥίζαι ψύχωνται τῶν φυτῶν. τῶν δὲ ζώων ἐπεὶ τὰ μὲν ἐστὶν ἔνυδρα τὰ δ' ἐν τῷ ἀέρι ποιεῖται τὴν διαίταν, ἐκ τούτων καὶ διὰ τούτων πορίζεται τὴν κατὰψυξιν, τὰ μὲν τῷ ὕδατι τὰ δὲ τῷ ἀέρι. τίνα δὲ τρόπον καὶ πῶς, λεκτέον ἐπιστήσας τὸν λόγον μᾶλλον'. Tr. Ross W.D. (*Complete Works*), vol. 1, 749. See also Freudenthal, *Aristotle's Theory of Material Substance* 71.

<sup>36</sup> Bourgey L., "Observation and Experiment in Analogical Explanation", in Barnes J. – Schofield M. – Sorabji R. (eds.) *Articles on Aristotle 1. Science* (London: 1975) 175–182.

<sup>37</sup> Aristoteles, *Metaphysica* 9.6, 1048a35–37, tr. Ross W.D. (*Complete Works*), vol. 2, 1655.

<sup>38</sup> Hankinson, "Science" 155. I agree with Hankinson's suggestion that Aristotle's analogies have no probative value; furthermore, he believes that Aristotle did not intend them to.

<sup>39</sup> See, for example, Arist. *Mete.* 2.3, 357a32–b1 on the analogy with the production of urine.

by Aristotle's frequent deployment of references to common experience: such analogies attempt to offer empirical support for explanations of distant phenomena, by making comparisons to familiar and more intimately observable occurrences.<sup>40</sup>

In the *Meteorology* Aristotle draws different types of comparisons, pointing to similarities between those phenomena which are familiar and those which are more difficult to access. Some of his comparisons are rather tentative, perhaps only intended to be suggestive. Sometimes he takes it for granted that we supply the details of the analogy ourselves, presumably because he considers the event to be so common. For example, as part of his argument that the motion of the Sun inflames air, Aristotle states that objects in motion are often found to melt, though he does not give specific examples.

Indeed, in many cases it is not clear whether Aristotle intends his familiar examples to serve 'merely' as an illustrative device (similar, perhaps, to the idea of a 'mere' analogy pointed to by the editors of this volume) or as a way of giving genuine explanatory information. It is possible to say 'conceive of X as analogous to Y' and for this to be understood in two different ways: simply as a means of illustrating something about X and, more richly, with the intention of the reader carrying across some understanding of Y and thinking that the same sort of thing holds for X. It is difficult to know the degree to which the use of an analogy indicates a strong commitment, on Aristotle's part, to what he regards as a genuinely correct explanation. Certainly, a useful illustration can serve a number of different ends, some of which may be pedagogical, without entailing any strong explanatory claim. Wilson has argued that analogy serves a special role more generally in Aristotle's scientific works, by providing a way in which a limited degree of unity across different scientific subjects may be achieved. A study more detailed than the necessarily brief consideration here should contribute to our understanding of the force of the physiological analogies in the *Meteorology*.<sup>41</sup>

---

<sup>40</sup> Different types of analogy are used in the *Meteorology*, as well as in other works in the Aristotelian corpus, notably the writings concerned with living beings. On Aristotle's use of analogy see, for example, Lloyd G.E.R., "Experiment in Early Greek Philosophy and Medicine", in Lloyd G.E.R., *Methods and Problems in Greek Science* (Cambridge: 1991) 77–78, and Lloyd, *Polarity and Analogy*, particularly ch. 6, "The Analysis of Argument from Analogy"; Hesse M.B., *Models and Analogies in Science* (Notre Dame, IN: 1966) chapter on "Aristotle's Logic of Analogy"; Fiedler W. *Analogiemodelle bei Aristoteles. Untersuchungen zu den Vergleichen zwischen den einzelnen Wissenschaften und Künsten* (Amsterdam: 1978).

<sup>41</sup> Wilson, *Unity of Science* 10–11, 53–115. Further, a consideration of the use of 'familiar' analogies with reference to Aristotle's more general epistemological distinctions regarding what is knowable might also prove useful.



*Analogy and metaphor in Epicurus' and Lucretius' explanations*

Analogies also feature in the explanations of physical phenomena offered by Epicurus and Lucretius. Epicurus' explanation of earthquakes depends on an analogy to the way in which buildings collapse.<sup>42</sup> He states:

Earthquakes may be due to the imprisonment of wind underground, and to its being interspersed with small masses of earth and then set in continuous motion, thus causing the earth to tremble. And the earth either takes in this wind from without or from the falling in of foundations, when undermined, into subterranean caverns, thus raising a wind in the imprisoned air. Or they may be due to the propagation of movement arising from the fall of many foundations and to its being again checked when it encounters the more solid resistance of earth.<sup>43</sup>

Lucretius draws out the analogy:

Whole mountains fall, and from the mighty shock  
Tremors spread abroad in an instant far and wide;  
Quite naturally, since buildings by the roadside  
Tremble with the shock of waggons passing by  
Of no great weight, and jump when the iron-shod wheels  
On either side jolt over stones or potholes.<sup>44</sup>

<sup>42</sup> See, for example, Long A.A. – Sedley D.N., *The Hellenistic Philosophers* (Cambridge: 1987), vol. 1, 63. Epicurean cosmology requires that phenomena be explained in purely physical terms; Epicurean explanations are non-teleological. A comparison of Aristotle's teleological stance (and its possible role in his use of physiological analogies) to the non-teleological explanations of the Epicureans might prove interesting. Some modern historians have referred to certain ancient explanations, for instance those of Epicurus and Lucretius, as 'mechanistic'. See Berryman S., *The Mechanical Hypothesis in Ancient Greek Natural Philosophy* (Cambridge: 2009) on the use of the terms 'mechanistic' and 'mechanical' by historians discussing the seventeenth century, as well as Antiquity; she also considers the presumed dichotomy between teleological and 'mechanistic' explanations.

<sup>43</sup> Epicurus, *Epistula ad Pythoclem* in Diogenes Laertius, *De clarorum philosophorum vitis* 10.105 'Σεισμούς ἐνδέχεται γίνεσθαι καὶ κατὰ πνεύματος ἐν τῇ γῇ ἀπόληψιν καὶ παρὰ μικροῦς ὄγκους αὐτῆς παρὰθεσιν καὶ συνεχῇ κίνησιν, ὃ τὴν κράδασιν τῇ γῇ παρασκευάζει. καὶ τὸ πνεῦμα τοῦτο ἢ ἔξωθεν ἐμπεριλαμβάνει <ἢ> ἐκ τοῦ πίπτειν εἰσὼ ἐδάφη εἰς ἀντροειδεῖς τόπους τῆς γῆς ἐκπνευματοῦντα τὸν ἐπειλημμένον ἀέρα. <καὶ> κατ' αὐτὴν δὲ τὴν διάδοσιν τῆς κινήσεως ἐκ τῶν πτώσεων ἐδαφῶν πολλῶν καὶ πάλιν ἀνταπόδοσιν, ὅταν πυκνώμασι σφοδρωτέροις τῆς γῆς ἀπαντήσῃ, ἐνδέχεται σεισμούς ἀποτελεῖσθαι'. Tr. Hicks R.D. 631–633.

<sup>44</sup> Lucretius, *De rerum natura* 6.547–551 'his igitur rebus subiunctis suppositisque | terra superne tremit magnis concussa ruinis, | subter ubi ingentis speluncas subruit aetas; | quippe cadunt toti montes magnoque repente | concussu late disserpunt inde tremores. | et merito, quoniam plaustris concussa tremescunt | tecta viam propter non magno pondere tota, | nec minus exultant, si quidvis cumque viai | ferratos utrimque rotarum succutit orbes'. Tr. Melville R.

But rather different analogies are used to explain other natural phenomena. So, for example, Lucretius offers the following explanation of rain-drops:

Now let me demonstrate how rainy moisture  
 Condenses in clouds high above, and falls  
 In a shower of rain upon the earth beneath.  
 First you will concede that many seeds [*semina*] of water  
 Rise up together with the clouds themselves  
 From things of every kind, and in this way  
 Both grow together, the clouds and whatever water  
 Is in the clouds, just as our bodies grow  
 Concurrently with the blood and sweat and whatever  
 Moisture there may in fact be in the limbs.<sup>45</sup>

In fact, the language used, by Epicurus and especially by Lucretius, often draws 'biological' analogies, particularly alluding to generation and corruption, two very important processes undergone by living beings. And many passages in Epicurus and Lucretius are replete with images of living things and processes that affect them: seeds, irrigation, creation and extinction.<sup>46</sup>

For example, Epicurus asserts (*Ep. Pyth.* 89) that it is possible for a *kosmos* (world) to arise in another *kosmos*, or in one of the *metakosmia* (the so-called *intermundia*, 'the spaces, or interstices' between worlds). He describes the flowing of 'seeds' from a single world, or from several, which 'undergo gradual additions or articulations or changes of place [...] waterings from appropriate sources, until they are matured and firmly settled in so far as the foundations laid can receive them'. As David Furley has noted, even though the text has difficulties and is vague, the language – employing words like 'seeds' and 'irrigations' – offers a 'biological' model

<sup>45</sup> Lucr. 6.495–503 'Nunc age, quo pacto pluvius conrescat in altis | nubibus umor et in terras demissus ut imber | decidat, expediam. primum iam semina aquai | multa simul vincam consurgere nubibus ipsis | omnibus ex rebus pariterque ita crescere utrumque | et nubis et aquam quaecumque in nubibus extat, | ut pariter nobis corpus cum sanguine crescit, | sudor item atque umor quicumque est denique membris'. Tr. Melville R., slightly altered, replacing 'atoms' with 'seeds', for *semina*.

<sup>46</sup> On the 'biological' imagery in Epicurus and Lucretius, see Furley D., "Cosmology" in Algra K. – Barnes J. – Mansfeld J. – Schofield M. (eds.), *The Cambridge History of Hellenistic Philosophy* (Cambridge: 1999) 425; Schrijvers P.H., "Seeing the Invisible: A Study of Lucretius' Use of Analogy in the *De rerum natura*", in Gale M.R. (ed.), *Oxford Readings in Classical Studies. Lucretius* (Oxford: 2007) 261; Taub L., "Cosmology and Meteorology" in Warren J. (ed.), *The Cambridge Companion to Epicureanism* (Cambridge: 2009) 116–118.

for the growth of *kosmoi*,<sup>47</sup> and the analogies to living things are vivid. Lucretius was motivated to present something more ‘decorated’ than Epicurus’ brief letters; he twice announces the ‘honeyed-cup’ character of his work. But his originality was not only manifested through the aesthetic poetic appeal, but through the intellectual possibilities his extended metaphors allowed for exploring and explicating some of the ideas contained in Epicurus’ and other philosophers’ work.

So, for example, Lucretius uses his biological metaphors to describe the world (*mundus*) itself. Building on the brevity of Epicurus, Lucretius describes, at some length, the ‘life cycle’ of our world, once again invoking images of living organisms at 2.1105–1174. Here, Lucretius represents the world as what may be called a *makranthrôpos*, an image which recurs in Books 5 and 6.<sup>48</sup> The term *makranthrôpos* is borrowed from Adolf Meyer (1900), to note that the ‘commonplaces’ described are taken from the human body and applied to the whole world.<sup>49</sup> Rather than the relationship between *mikrokosmos* and *makrokosmos*, we have *anthrôpos* and *makranthrôpos*: the *kosmos* is depicted as a large-scale *anthrôpos*, a living human being. The passage in Lucretius is lengthy and beautiful, offering a sober end to Book Two. Having used language that evokes biological functions and processes, emphasising growth, nourishment and decay, Lucretius closes his discussion (2.1164–1174) of the cosmic ‘life-cycle’ bemoaning the current state of the earth and of agriculture, which no longer produces food in abundance as it once did, food and nourishment necessary to sustain, through physiological processes of digestion, human life.

There are questions that can be raised about the significance of the particular type of metaphor used – the body – to refer to how macrocosmic processes are understood. Is this a reductive treatment? Is everything meant to be understood relative to humans? Does it make human beings central? Does it make concerns about the human body – including health, disease and medicine – particularly important?<sup>50</sup>

This passage suggests that the world, the *kosmos*, in a similar manner to living organisms, has a fixed life-cycle, being subject to growth and

<sup>47</sup> Furley, “Cosmology” 425.

<sup>48</sup> Solmsen F., “Epicurus on the Growth and Decline of the Cosmos”, *American Journal of Philology* 74 (1953) 34–51, esp. 38–39; cf. Schrijvers, “Seeing the Invisible” 272–273.

<sup>49</sup> Meyer A., *Wesen und Geschichte der Theorie vom Mikro- und Makrokosmos* (Bern: 1900). See also Schrijvers, “Seeing the Invisible” 271; Lloyd, *Polarity and Analogy* 252; Mansfeld, J., *The Pseudo-Hippocratic Tract περί ἐβδωμάδων Ch. 1–11 and Greek Philosophy* (Assen: 1971) 104–105. Cf. Garani, *Empedocles redivivus* 77–81.

<sup>50</sup> I thank Aude Doody for her insights here.

decline. Our world – as well as the other worlds, or *kosmoi* – is not immortal and everlasting, but will cease to exist. Like living beings, these worlds, these *kosmoi*, grow, decline, and finally come to an end.<sup>51</sup> The mortality of the Epicurean *kosmoi* is in sharp contrast to the immortal and unchanging nature of, for example, the Aristotelian *kosmos*.<sup>52</sup> Furthermore, Lucretius appears to have taken a rather brief reference to an analogy in Epicurus – here between a living thing (*zôion*) and the cosmos or the Earth – and developed it into an elaborate metaphor.<sup>53</sup>

In this way, Lucretius ends up in a seemingly paradoxical position. On the one hand, the Epicureans, including Lucretius, ‘categorically deny that the earth is a living thing and that the cosmos has a soul’.<sup>54</sup> Yet, Lucretius develops and exploits an analogy, through an elaborate metaphor, of the world as a living thing (possibly even a *makranthrôpos*), subject to physiological processes similar to other living beings. If Lucretius did not regard the cosmos as a living being, why did he draw out the Epicurean analogy into elaborate metaphors pointing to similarities between the cosmos and living things? Aristotle had earlier asserted that metaphor conveys meaning; the metaphors developed by Lucretius require philosophical engagement in order to understand the limits of their meaning.

Piet Schrijvers, in a seminal article, posits that the elaboration allows the exploration of ideas within a framework posited by the analogy.<sup>55</sup> Through his repeated and elaborated references to human bodies, Lucretius draws on analogies which are familiar to all of us, and which would have been familiar to all of his readers. These ‘biological’ analogies transcend historical time, place and culture, and make reference to what is most familiar to us: our own bodies. As Schrijvers has suggested: ‘Lucretius’ cosmology has the effect of belittling the importance of things usually experienced as awe-inspiring’. Instead of emphasising a possible relationship of macrocosm/microcosm, Lucretius uses the metaphor of the *makranthrôpos*,

<sup>51</sup> See Solmsen, “Epicurus on the Growth and Decline of the Cosmos”, 50, citing fragment 305 in Usener’s edition (=Aëtius 2.4). Asmis, *Epicurus’ Scientific Method* 314–315 comments briefly on the idea that the growth and decline of worlds is analogous to the growth and decline of living beings. It is worth noting that all composite bodies come to be and are eventually dissolved (Epicurus, *Epistula ad Herodotum* in Diogenes Laertius, *De clarorum philosophorum vitis* 10.42).

<sup>52</sup> See Solmsen, “Epicurus on the Growth and Decline of the Cosmos” 50 n. 62.

<sup>53</sup> See Schrijvers, “Seeing the Invisible” 272–276.

<sup>54</sup> Schrijvers, “Seeing the Invisible” 273–274.

<sup>55</sup> Schrijvers, “Seeing the Invisible” 257–258, following the suggestion of the use of ‘root metaphors’ in Black M., *Models and Metaphors. Studies in Language and Philosophy* (Ithaca: 1962).

to build on analogies to *anthrôpoi*.<sup>56</sup> The emphasis is on the similarity to the human, the familiar: ‘The comparisons established between grandiose cosmic phenomena and the minute scale of the human body have the psychological consequence that, thanks to these parallels, the miraculous and terrifying quality of the *paradoxa* is diminished’.<sup>57</sup> Furthermore, the elaborated metaphors constructed by Lucretius upon references to living things confirm the power and importance, asserted by Aristotle, Epicurus, and others (including Theophrastus and Seneca, for example) of arguing by analogy to familiar things.<sup>58</sup>

The elaborate metaphorical references drawn by Lucretius to the cosmos as a living being, with similarities to a human being, are especially powerful and compelling. This is the novelty, the ‘freshness’, of Lucretius’ elaboration of the analogy of the Earth to living things into the metaphor of the cosmos as *makranthrôpos*. What is more familiar to us than our own bodies, and the processes they undergo?

### *Analogies in seventeenth-century English explanations*

The appeal of analogies and metaphors that draw on the familiarity of human physiology were powerful not only in Greco-Roman Antiquity, but in the Early Modern period as well. Ancient accounts of natural phenomena existed alongside newly emerging methods of explanation; in a number of fields, including geology and meteorology, metaphors derived from physiology gained popularity. While a detailed examination of such analogies and metaphors in early modern authors is not possible here, even a brief look at some English-language writings gives a sense of their continued use and appeal; a consideration of early modern authors writing in other languages would likely uncover further material worthy of study.

As an example, just as Aristotle had used images of an ‘internal’ wind,<sup>59</sup> so too did a number of seventeenth-century authors writing in English.

<sup>56</sup> Schrijvers, “Seeing the Invisible” 271 notes that the microcosm image is applied, in the strict sense, to humans beings (as a smaller version of the cosmos) only once by Lucretius (at 3.487–509).

<sup>57</sup> Schrijvers, “Seeing the Invisible” 276.

<sup>58</sup> Althoff J., “Vom Schicksal einer Metapher: Die Erde als Organismus in Senecas *Naturales Quaestiones*”, *Antike Naturwissenschaft und ihre Rezeption* (Trier: 1997), vol. 7, 95–110.

<sup>59</sup> See, for example, Arist. *Mete.* 366b14–22, 368a6–11.

The analogies invoked are not 'new', but seem to be a repetition of what we have seen before, in ancient Greek and Roman authors. In some cases, analogies and metaphors persist, through early modern authors consciously relating to ancient ideas, for example, in quotations from and references to earlier works. In other instances, it is not clear whether early modern authors realised that similar analogies and metaphors had been used in Greco-Roman Antiquity.

As an example in which the author makes deliberate reference to ancient ideas, as part of his review of accounts of earthquakes found in the writings of ancient natural philosophers, as well as the Bible, Thomas Doolittle, in *Earthquakes Explained and Practically Improved* (London: 1693), cited Aristotle directly:

Aristotle Book. 2. *Meteorology* proves that Exhalations are the cause of the Earthquake.

1. From a similitude taken from Mens Bodies, in which there are sometimes such Convulsions, Shakings and Tremblings, that many Men can scarce hold such a one, the cause whereof are Spirits hot and dry. In like manner, when the vast Body of the Earth is moved, it is to be referred to Exhalations, which are hot and dry.

Aristotle is only one of a number of Greek and Roman philosophical authors, including Posidonius and Seneca, whose ideas are discussed. However, Doolittle also reports the views of some of his own contemporaries. For example, a few pages later, he adds that an earthquake 'is commonly described' as 'a Meteor arising from abundant Exhalations shut up in the bowels of the Earth, "which while they seek a passage out that they may ascend, but cannot find it, cause the Earth to shake"'. Here, Doolittle appears to be speaking of current views, and not only those of the ancients, for earlier in this section he refers to the ideas of Jacques Rohault (1618–1672), as discussed in his treatise on physics. Intriguingly, Doolittle notes that not all uses of terminology relating to earthquakes refer to geological events: some accounts of 'earthquakes' are metaphorical, describing great changes in 'states, kingdoms and church'.<sup>60</sup>

<sup>60</sup> Doolittle T. *Earthquakes Explained and Practically Improved* (London, John Salusbury: 1693) 55 (Aristotle quoted); 53 (citing Rohault); 57–58 (further discussion of earthquakes); 28–31 (on metaphorical uses of terms related to 'earthquake'). Some authors use the word 'bowels' without making an explicit analogy to digestive anatomy or processes, for example Woodward J., *The Natural History of the Earth* (London, Richard Wilkin: 1695). On some late seventeenth-century ideas concerning earthquakes, see Willmoth F., "John Flamsteed's Letter Concerning the Natural Causes of Earthquakes", *Annals of Science* 44 (1987) 23–70, especially 32–67.

The vivid use of analogy is evident in other descriptions of the Earth, as well as of meteorological or geological phenomena; while digestive and nutritive organs and processes were often invoked, other body parts and even illness were also referred to. So, for example, C. H[allywell], in *A Philosophical Discourse of Earthquakes* (London: 1693), describes the earth as having 'infinite Burrows and Cavities [...] like the Ramifications of Veins, and Nerves, and Arteries in the Humane Body'.<sup>61</sup> In 1694 'R.B'. [Robert Burton, pseudonym of Nathaniel Crouch] explained that during 'these two or three years past', when there were a number of earthquakes felt in Europe as well as America, 'some have been of the opinion that the Earth was a great Animal, and that the shivering of some Ague Fit was the Cause of his trembling'.<sup>62</sup>

These analogies are very brief, and are not elaborated into metaphors, as they were by Lucretius. In some instances they appear to be taken explicitly from ancient authors, notably Aristotle himself, and possibly also Seneca, who in his *Natural Questions* discusses a number of analogies between the earth and the body, including those offered by other natural philosophers in their own explanations.<sup>63</sup>

### Conclusion

The analogies drawn by the early modern authors cited here are familiar and, as in Lucretius, human.<sup>64</sup> (This may assume some consensus on human physiology, and that the reader is aware of or agrees with explanations offered, or insinuated.) Analogies may serve a number of functions, including illustrative, pedagogical and/or explanatory; individual authors and readers may well have intended and understood the seemingly same analogy differently.

<sup>61</sup> H[allywell] C. *A Philosophical Discourse of Earthquakes* (London, printed for Walter Kettilby, at the Bishop's Head in St. Paul's Church-Yard: 1693) 3.

<sup>62</sup> R.B. [Burton Robert, pseud. for Nathaniel Crouch] *A General History of Earthquakes* [...] (London, Nath. Crouch: 1694) 163. R.B. goes on to explain that there are two natural causes of earthquakes (subterranean fires and winds, and water under the Earth undermining the foundations of subterranean vaults). On 4, he had described 'the great Caves and Dens of the Earth being always full of Air'.

<sup>63</sup> For example, Seneca, *Naturales Quaestiones* 6.14.1–2; see also Althoff, 'Vom Schicksal einer Metapher' and Taub, *Ancient Meteorology* 150–152.

<sup>64</sup> The analogy between the earth and living bodies may rely on superficial or accidental similarities, rather than similarity of cause; that does not deny the usefulness of the analogy.



For the philosophical authors considered here, the Earth was not a living thing, and the analogies and metaphors invoking the human body suggest certain potential problems and misunderstandings. We might even ask the question, how far does analogical and metaphorical thinking 'contaminate' understanding of a phenomenon in its own right? Is there too great a danger of literal readings, or of wrong conclusions reached, for instance that the Earth is itself animate? With this in mind, it is worth noting that a number of ancient authors, including Plutarch, Cicero and Quintilian, specifically pointed to the power of metaphors that link the inanimate to the animate, going so far as to use analogy and personification.<sup>65</sup> The analogies and metaphors used by our authors indicate that a consideration of living bodies, human and otherwise, could aid in understanding and explaining other natural, but inanimate, phenomena. That the Earth was not a living being may have made the analogies and metaphors invoking physiological processes even more compelling; their power was achieved simultaneously through both novelty as well as intimate familiarity.

---

<sup>65</sup> Innes D., "Metaphor, Simile, and Allegory as Ornaments of Style", in Boys-Stones G. (ed.), *Metaphor, Allegory, and the Classical Tradition. Ancient Thought and Modern Revisions* (Oxford: 2003) 16 on the relationship between the animate and inanimate as an important type of metaphor, discussed by Philodemus, Plutarch, Cicero and Quintilian. See also Schenkeveld D.M., *Studies in Demetrius On Style* (Amsterdam: 1964) 90, cited by Innes.

### Selective bibliography

- ALTHOFF J., "Vom Schicksal einer Metapher: Die Erde als Organismus in Senecas Naturales Quaestiones" *Antike Naturwissenschaft und ihre Rezeption*, Bd. 7 (Trier: 1997) 95–110.
- ARISTOTLE: *Historia animalium*, tr. Thompson d'A.W. (1984), *History of Animals*, ed. Barnes J., *The Complete Works of Aristotle, The Revised Oxford Translation*, vol. 1, Princeton.
- , *Metaphysica*: tr. Ross W.D. (1984), *Metaphysics*, ed. Barnes J., *The Complete Works of Aristotle. The Revised Oxford Translation*, vol. 2, Princeton.
- , *Meteorologica*: ed. Fobes F.H. (1919), *Aristotelis Meteorologicorum libri quattuor* (Cambridge, Mass.).
- , *Meteorologica*, tr. Lee H.D.P. (1952), Loeb Classical Library, Cambridge, Mass.
- , *Meteorologica*: tr. Webster E.W. (1984), *Meteorology*, ed. Barnes J., *The Complete Works of Aristotle. The Revised Oxford Translation*, vol. 1, Princeton.
- , *Analytica posteriora*: tr. Barnes J. (1975), *Posterior Analytics*, Oxford.
- , *Analytica posteriora*: tr. Barnes J. (1984), *Posterior Analytics*, ed. Barnes J., *The Complete Works of Aristotle. The Revised Oxford Translation*, vol. 1, Princeton.
- , *Rhetorica*: tr. Roberts W.R. (1984), *Rhetoric*, ed. Barnes J., *The Complete Works of Aristotle. The Revised Oxford Translation*, vol. 2, Princeton.
- , *The Complete Works of Aristotle. The Revised Oxford Translation*, ed. Barnes J., 2 vols. (Princeton: 1984).
- ASMS E., *Epicurus' Scientific Method* (Ithaca: 1984).
- BAILER-JONES D.M., "Models, Metaphors and Analogies", in Machamer P. – Silberstein M. (eds.), *The Blackwell Guide to the Philosophy of Science* (Malden, Mass.-Oxford: 2002) 108–127.
- BALME D.M., *Aristotle's De Partibus Animalium I and De Generatione Animalium I* (Oxford: 1972).
- BARNES J., "Aristotle's Theory of Demonstration", *Phronesis* 14 (1969) 123–152.
- BERRYMAN S., *The Mechanical Hypothesis in Ancient Greek Natural Philosophy* (Cambridge: 2009).
- BLACK M., *Models and Metaphors. Studies in Language and Philosophy* (Ithaca: 1962).
- BOURGEY L., "Observation and Experiment in Analogical Explanation", in Barnes J., Schofield, M. – Sorabji, R. (eds.), *Articles on Aristotle 1. Science* (London: 1975) 175–182.
- 'R.B'. [Burton Robert pseudonym for Crouch Nathaniel], *The general history of earthquakes being an account of the most remarkable and tremendous earthquakes that have happened in divers parts of the world, from the creation to this time, as they are recorded by sacred and common authors, and particularly those lately in Naples, Smyrna, Jamaica and Sicily. With a description of the famous burning mount, Aetna, in that island, and relation of the several dreadful conflagrations and fiery irruptions thereof for many ages. Likewise the natural and material causes of earthquakes, with the usual signs and prognosticks of their approach, and the consequents and effects that have followed several of them* (London, Nath. Crouch: 1694).
- CUNNINGHAM A., "Aristotle's Animal Books: Ethology, Biology, Anatomy, or Philosophy?", *Philosophical Topics* 27 (1999) 17–41.
- DOOLITTLE T., *Earthquakes Explained and Practically Improved* (London, John Salusbury: 1693).
- [EPICURUS], *Epicurea*, ed. Usener H. (Leipzig: 1887).
- , "Letter to Pythocles", tr. Hicks R.D. in *Diogenes Laertius. Lives of Eminent Philosophers* 10.83–117, 2 vols. (Cambridge, Mass.: 1925), vol. 2, 612–643.
- FIEDLER W., *Analogiemodelle bei Aristoteles. Untersuchungen zu den Vergleichen zwischen den einzelnen Wissenschaften und Künsten* (Amsterdam: 1978).
- FREUDENTHAL G., *Aristotle's Theory of Material Substance. Heat and Pneuma, Form and Soul* (Oxford: 1995).
- FURLEY D., "Cosmology", in eds. Algra K. – Barnes J. – Mansfeld J. – Schofield M. (eds.), *The Cambridge History of Hellenistic Philosophy* (Cambridge: 1999) 412–451.

- GARANI M., *Empedocles redivivus. Poetry and Analogy in Lucretius* (London: 2007).
- H[ALLYWELL] C., *A Philosophical Discourse of Earthquakes* (London, printed for Walter Kettilby, at the Bishop's Head in St. Paul's Church-Yard: 1693).
- HANKINSON R.J., "Science", in Barnes J. (ed.), *The Cambridge Companion to Aristotle* (Cambridge: 1995) 140–167.
- HESSE M.B., *Models and Analogies in Science* (Notre Dame, IN: 1966).
- HIPPOCRATES, *De humoribus*: ed. Littré É. (1846), *Oeuvres complètes d'Hippocrate*, vol. 5, Paris [repr. Amsterdam 1962, 476–503].
- INNES D., "Metaphor, Simile, and Allegory as Ornaments of Style", in Boys-Stones G. (ed.), *Metaphor, Allegory, and the Classical Tradition. Ancient Thought and Modern Revisions* (Oxford: 2003).
- INWOOD B., "The Origin of Epicurus' Concept of Void", *Classical Philology* 76 (1981) 273–285.
- LLOYD G.E.R., "Experiment in Early Greek Philosophy and Medicine", in Lloyd G.E.R., *Methods and Problems in Greek Science* (Cambridge: 1991) 70–99 [Originally published in *Proceedings of the Cambridge Philological Society* N.S. 10 (1964) 50–72].
- , *Polarity and Analogy. Two Types of Argumentation in Early Greek Thought* (Cambridge: 1966).
- LONG A.A. – SEDLEY D.N., *The Hellenistic Philosophers*, 2 vols. (Cambridge: 1987).
- LUCRETIUS, *De rerum natura*: tr. Melville R. (1997), *On the Nature of the Universe*, Oxford.
- MANSFELD J., *The Pseudo-Hippocratic Tract περί ἐβδωμάδων Ch. 1–11 and Greek Philosophy* (Assen: 1971).
- MATTHEN M., "The Holistic Presuppositions of Aristotle's Cosmology", *Oxford Studies in Ancient Philosophy* 20 (2001) 171–199.
- MEYER A., *Wesen und Geschichte der Theorie vom Mikro- und Makrokosmos* (Bern: 1900).
- RAPP C., "Aristotle's Rhetoric", *The Stanford Encyclopedia of Philosophy* (Winter 2008 Edition), Zalta E.N. (ed.), URL = <<http://plato.stanford.edu/archives/win2008/entries/aristotle-rhetoric/>>.
- RIST J.M., *Epicurus. An Introduction* (Cambridge: 1972).
- SCHENKEVELD D.M., *Studies in Demetrius On Style* (Amsterdam: 1964).
- SCHRIJVERS P.H., "Seeing the Invisible: A Study of Lucretius' Use of Analogy in the *De rerum natura*", in Gale M.R. (ed.), *Oxford Readings in Classical Studies. Lucretius* (Oxford: 2007) 255–288 [Translation of "Le regard sur l'invisible", in Gigon O. (ed.), *Lucrèce*, Fondation Hardt Entretiens sur l'antiquité classique 24 (1978)].
- SEDLEY D., "Epicurus on Nature Book XXVIII", *Cronache ercolanesi* 3 (1973) 5–83.
- , "Lucretius and the New Empedocles", *Leeds International Classical Studies* 2 (2003) 1–12.
- SOLMSSEN F., "Epicurus on the Growth and Decline of the Cosmos", *American Journal of Philology* 74 (1953) 34–51.
- TAUB L., *Ancient Meteorology* (London: 2003).
- , "Cosmology and Meteorology", in Warren J. (ed.), *The Cambridge Companion to Epicureanism* (Cambridge: 2009) 105–124.
- , "Das Lebewesen und die Erde: Analogie oder Metapher in physikalischen Erklärungen der Antike?", *Antike Naturwissenschaft und ihre Rezeption*, vol. 20 (Trier: 2010) 65–79.
- WILLMOTH F., "John Flamsteed's Letter concerning the Natural Causes of Earthquakes", *Annals of Science* 44 (1987) 23–70.
- WILSON M., *A More Disorderly Nature* (forthcoming).
- , "A Somewhat Disorderly Nature: Unity in Aristotle's *Meteorologica* I–III", *Apeiron* 42 (2009) 63–88.
- , "Analogy in Aristotle's Biology", *Ancient Philosophy* 17 (1997) 335–358.
- , *Aristotle's Theory of the Unity of Science* (Toronto: 2000).
- WOODWARD JOHN, *The Natural History of the Earth* (London, Richard Wilkin: 1695).



## THE RECEPTION OF THE HIPPOCRATIC TREATISE *ON GLANDS*

Elizabeth Craik

### *Summary\**

Authorship, date and milieu are first considered. It is noted that ancient medical knowledge of glands and the lymphatic system depends on comparative anatomy; culinary use and sacrificial practice are significant. The approach of early modern editors such as Foesius and Zwinger to the work and the citations of doctor-philologists such as Caius are discussed. In reactions to the discoveries of Aselli and others, many Hippocratic works were cited, but rarely *On Glands*, despite its relevance to debates on the nature, routes and contents of bodily ducts, as well as to debates on teleology and to debates on the value of comparative anatomy. General and more particular explanations for this neglect are suggested. The work of van der Linden, van Horne and others is discussed. It appears from the selective nature of citation that familiarity was restricted to certain parts of *On Glands* while its overall visionary character went unnoticed.

### *Introduction*

According to a recent medical judgment of the Hippocratic treatise *On Glands*:

The modern scientist stands amazed before the innovative concepts expounded in this ancient medical document. Indeed, the functional anatomy of the lymphatic system and lymph nodes emerges with impressive precision [...] an absolutely modern interpretation of their physiopathological significance.<sup>1</sup>

The seventeen sections of this short treatise can be summarised as follows: the general character of glands in nature and appearance is

---

\* I am much indebted to Professor Manfred Horstmanshoff, Professor Vivian Nutton and Dr. Thomas Rütten for helpful comments on an earlier draft of this paper. For edition, with introduction, translation and commentary of the treatise, see Craik E.M., *The Hippocratic Treatise On Glands, Edited and Translated with Introduction and Commentary* (Leiden: 2009); this paper extends and amplifies section III of the introduction.

<sup>1</sup> Crivellato E. – Travan L. – Ribatti D., "The Hippocratic Treatise '*On Glands*': The First Document on Lymphoid Tissue and Lymph Nodes", *Leukemia* 21 (2007) 591–592.

outlined (1); the nature and cause of maladies affecting them is described (2); their distribution and function is indicated (3); an association of glands, moisture and hair is postulated (4); it is allowed that hair is absent from some places where glands are present (5). Particular glandular areas are discussed: the kidneys (6); the neck (7); the armpits and groin (8); the intestines (9); the head, specifically the brain (10). It is stated that the head may send an excess of moisture in flux to the ears, the eyes, the nose, the throat, the oesophagus, the spine or the hip joint (11); and that the brain itself may be affected if this flux goes wrong (12). The relatively minor hazards of fluxes to the eyes, nose and ears are outlined (13); flux via the oesophagus (to the belly) and via the trachea (to the lungs) and the dangers of flux to the hips are described (14). It is noted that the brain may suffer other dangerous maladies, affecting the rest of the body also (15). Finally, a glandular difference – breasts – between men and women is discussed (16–17).

The Hippocratic writer makes a serious and wide-ranging attempt to observe the broad anatomy, to understand the underlying physiology, and to account for the general pathology of glands. The opening words of the treatise are programmatic: 'On glands as a whole, this is the situation'; that is, the system is discussed. The perception that distant and apparently disparate parts of the body, which can be described and identified, have an underlying connection and similar function demonstrates a fundamental insight in both anatomical and physiological terms. The pathological content is similarly impressive in its recognition of systemic disease. The author's remarkable achievement in addressing and accomplishing such an ambitious enterprise defies the inherent complexity of the topic, and prefigures the long gradual process of discovery, observation and deduction which underlies present day knowledge of glands and the lymphatic system. To some extent, the modern process of discovery, beginning in the seventeenth century AD, is parallel to the ancient, of the fourth century BC. This paper outlines some parallels and suggests reasons for the apparent failure in the Early Modern period to recognise the insights contained in *On Glands*. The author's all-embracing approach, with its recognition that glandular parts belong to an integrated system, is his greatest achievement and yet paradoxically may be the main reason for neglect of his work by later authors, who were concerned for the most part with limited parts of that system. But there are other reasons also, related to early modern approaches to Hippocratic texts and preconceptions about their content.

It is evident that there is an initial problem of definition. Our author has two main criteria in identifying glands: firstly, they are alike in anatomy with regard both to appearance (spongy, fatty and white) and to location (in bodily 'joints' and 'cavities'); and secondly, they are alike in pathology (fever, pustules and scrofulous swellings): the supposed common physiology (bodily drainage), on which much stress is laid, is apparently a theoretical adjunct. The particular glandular areas noted – areas believed either to *be* glands or to *have* glands – are these: the kidneys; the neck (tonsils); the armpits; the groin; the intestines; the head, specifically the brain; and, in women, the breasts. In reality, glands vary widely in nature and size, and lymph nodes too are diverse: it is difficult to find a simple description equally apt to all. Description and definition are still problematical. Although there is a broad consensus on the general texture and appearance of glands and lymph nodes it is noticeable that even in modern textbooks the term 'gland' is often accompanied or replaced by more vague expressions such as 'glandular tissue'. Expressions such as 'gland-like', 'glandular'; 'flesh-like', 'fleshy'; 'sponge-like', 'spongy'; 'fat-like', 'fatty', recurrent in ancient attempts at description, are not without parallels in modern medical literature.

### *Authorship, date and milieu*

Who is the author? Questions of date and intertextuality, always problematical with regard to the Hippocratic Corpus, are here acute.<sup>2</sup> Discussion of authorship has been much influenced by the disparaging and dismissive judgment of Galen that *On Glands* falls far short of true Hippocratic writings in 'expression and thought' and is the work of 'one of the later Hippocratics'. Galen made these pronouncements in commenting on a passage of the Hippocratic work *Articulations* where the author states his intent to write 'on glands as a whole'. As this replicates the opening sentence of *On Glands* the possibility of common authorship arises, and has been much discussed.<sup>3</sup> It is true that some elements suggest affinities with *Articulations* (and the related treatise *Fractures*); further, some elements suggest affinities with *Places in Man*. But these are scarcely indicative of common authorship.

<sup>2</sup> See Craik E.M., "[Hippocrates] *On Glands*", forthcoming in *Proceedings of Colloque International Hippocratique XIII*.

<sup>3</sup> Galenus, *In Hippocratis de articulis librum commentarii* 45 (18A.379 K.).



Rather, on the basis of cumulative evidence in both content and expression, it appears that the author of *On Glands* is the author also of *Generation-Nature of the Child* (on matters of conception and embryology) and *Diseases IV* (on topics in physiology and nosology), as well as of a large body of material in the gynaecological texts transmitted in the Hippocratic Corpus, including the short piece *Diseases of Girls*. An important implication is that there was considerable awareness of glandular anatomy, physiology and pathology among Hippocratic doctors, especially among those with an interest in the female body: the vast and sprawling gynaecological works are not just an amalgam of old wives' tales and recipes, but are in parts highly sophisticated in content. On the basis of this unexpected and unexpectedly early grouping, *On Glands* may plausibly be dated to the early decades of the fourth century. The author responsible for this substantial fraction of the 'Hippocratic' writings is an important and original thinker, who occupies a pivotal place between the thought of the 'Presocratics' and the researches of the Academy (Plato) and the Lyceum (Aristotle).<sup>4</sup>

The author might be viewed as a doctor with a scientific bent (interested in botany and zoology) or as a scientist with medical interests (concerned with human as well as animal function); but in truth any such categorisation is anachronistic. In fifth- and fourth-century terms he belongs among the *iatrotechnai* or intellectual 'doctor-scientists' parodied by Aristophanes in *Clouds* of which the first version was produced in 423 BC. The most pervasive underlying presence is that of Democritus. Although Democritus is not generally viewed as a 'doctor', it is remarkable that many of his works have titles the same as, or similar to, several which are transmitted in the Hippocratic Corpus: it seems he wrote on the nature of man or on flesh; on humours; and on dietetics. In addition, tradition records a treatise on fever and chronic cough, suggesting an interest in consumptive illnesses, shared with our author. Speculation on the formation of the body and of its different components was a topic of general interest; but it is notable that Democritus gives a similar account of the formation of horn to that essayed in *On Glands* on the formation of hair. There is a vivid vignette contained

---

<sup>4</sup> To assess more precisely the extent of his oeuvre it would be necessary to reconsider the extent of Grensemann's postulated Schicht C; see Grensemann H., *Knidische Medizin, Teil I. Die Testimonien zur ältesten Knidischen Lehre und Analysen Knidischer Schriften im Corpus Hippocraticum* (Berlin-New York: 1975) and *Hippokratische Gynäkologie. Die gynäkologischen Texte des Autors C nach den pseudohippokratischen Schriften De muliebribus I, II und De sterilibus* (Wiesbaden: 1982).

in the Hippocratic letters: Democritus is presented as cutting up many animals, scrutinising their 'innards' in order to assess the 'nature and place of bile' (*Letters* 17 [9.352 L.]), an excess of which is said to cause illness. Similarly, in a Democritean account of the body, bile is said to be destructive if it 'overflows' (*Letters* 23 [9.392 L.]): these concepts are similar to those of *On Glands*. In addition, Democritus wrote on topics in embryology, explaining multiple births in such animals as dogs and pigs, a topic covered in similar terms in *Nature of the Child*.

### *Ancient anatomical knowledge*

Ancient anatomical knowledge, including knowledge of glands and the lymphatic system, undoubtedly depended on comparative anatomy. Aristotle was familiar with glands in such animals as cat, dog, pig, sheep and ox: his account of glands includes descriptions of tonsils, breasts (udders), genitals, axilla, throat, groin and mesenterion and is couched in terms rather similar to those used in the Hippocratic treatise. Other animals he is known to have dissected include the hare, deer, mouse, hyena, ass, leopard and weasel; also the seal and ox. In *On Regimen*, the main Hippocratic account of the relative values and qualities (hot, cold, wet, dry) of different kinds of meat, more attention is paid to different animal species than to different cuts; but from lists of animals recommended as foodstuffs, it is evident that cooks would have been familiar with the carcasses of the ox, goat, piglet and pig, lamb and sheep, ass, puppy and dog, wild boar, deer, hare, fox and hedgehog – as well as a wide range of birds and fishes. The culinary importance of 'glands' – which we might recognise rather as 'offal' – is evident also from many passages quoted in Athenaeus. Sow's udder was a glandular delicacy and stuffed spleen seems to have been particularly prized; also liver, fried and wrapped in a 'caul' (*epiploon*).<sup>5</sup> In one Hippocratic case-history, prescribing a light diet for an invalid, sweetbreads and testicles are recommended: after the regular pulse soups, the invalid is to eat 'boiled puppy', then graduate to sweet soft glandular foods (*Epidemics* 7.62 [5.428 L.]).

Galen is well aware that there are many glands in the body. In his view, they are not all equally necessary or useful, but there is a relative need

---

<sup>5</sup> This resembles many types of sausage; also the haggis of Scotland, properly containing sheep's innards encased in a sheep's stomach.

for those which provide saliva, milk or semen and those which furnish 'phlegm-like moisture' in the mesenterion and elsewhere. There is some hesitation over detail and definition; some glands may be regarded rather as 'glandular bodies', these being more fine and more spongy than other glands, and this somewhat strange phrase is recurrent. Galen's lack of precision can be accounted for by the complexity of the subject, or perhaps simply because anatomical detail is not here the main thrust of his account. As to the physiology of glands, Galen concurs with the Hippocratic author that their function is to monitor bodily moisture, and remove any surplus. Glands have as their function 'to accommodate excess' and 'to receive flux'.<sup>6</sup> As to the pathology of glands, Galen is again at one with the Hippocratic writer. Hard swellings in the groin or armpits are described by the Hippocratic term 'scrofula'. In short, no great advance is evident between the classical and the Galenic understanding.

Galen's most extended account of glands is in the section 'on glands' in a long account of foodstuffs; the culinary importance of glands is here corroborated. In Galen's account, it is implied that, whereas most people know only large glands, such as the tonsils, he is familiar with many small ones; those of the mesentery are specified. Galen includes the thymus gland, which is especially large in the neck or breast of young animals. This clearly refers to 'sweetbreads' as they are now called, two distinct white fatty glands taken from calves or lambs, one lying immediately below the throat and the other (rounder in shape and more prized by connoisseurs) lying nearer the heart. Galen remarks that all glands in common are sweet and 'tender' to eat.

As in the kitchen, there were regular opportunities to view animal carcasses in temples: animal sacrifice – of different animals, such as bulls, sheep, pigs and goats dedicated to different gods – played an important part in cult practice; butchers as well as priests must have been present. The liver was peculiarly important and examination especially of bile played a crucial part in haruspicy, interpretation of omens. One Euripidean description of inauspicious omens refers in correct anatomical detail to the 'lobe' (projecting part) of ox liver, to the 'gates' (indentations where vessels connect with it) and to the neighbouring 'bile ducts'; an Aeschylean passage refers in more general terms to the colour and texture of the organs and

---

<sup>6</sup> Alongside this very traditional view of peccant matter coursing from the brain and arriving at bodily orifices there is a quite sophisticated awareness of the presence and importance of the pineal gland in the brain, 'in actuality a gland, but in appearance very like a cone' (hence its name, *konarion*), serving, in conjunction with other glands, as 'a sort of custodian and monitor' in important bodily functions.

the divinely approved good appearance of bile and lobe (Euripides, *Electra* 827–829; Aeschylus, *Prometheus Bound* 494–495). Ancient doctors evidently had regular access to ox bile as this was a common gynaecological specific, used as an emollient along with fat (frequently from geese) and bone marrow (frequently from deer).<sup>7</sup> In the Hellenistic period, at sacrifices on Kos, where the epigraphical evidence is particularly informative, different cuts were allocated to different groups in the community, including ‘doctors’. A particularly important festival involved sacrifice of a bull to Zeus Polieus. (It is just possible that the thoracic duct was visible in large bovines, when killed by slitting the throat. Rudbeck claimed to have seen this duct when a calf was being slaughtered; but of course he knew just where and how to look.)

### *Early editors and doctor philologists*

We turn to the Early Modern period. *On Glands* has a place in the translation of Marcus Fabius Calvus (1525) and in all the early complete collections of Hippocratic texts, those of Janus Cornarius (1538) and Anutius Foesius (1595; cf. *Oeconomia*, 1588) being particularly influential, and it is included in the important though limited (twenty-two works) selection of Theodor Zwinger (1579). This reflects Zwinger’s interest in physiology, seen in his pioneering *Physiologica medica* (1588; published posthumously 1610). Doctor-philologists looked to the newly revived medicine of Hippocrates for insights relevant to current medical theory and practice.

In this intellectual climate, John Caius (earlier a friend of Andreas Vesalius at Padua; in later life influential in the renewal of Caius – previously Gonville – College, Cambridge, where Harvey became a student in 1593) made remarkable use of *On Glands*. He included it in a conjectural reconstruction of a putative lost Hippocratic work on anatomy: ‘much (as we believe) scattered; now (but by our conjecture) reconstituted’<sup>8</sup> Caius’ theory was that the works *On Anatomy*, *On Bones*, *On the Heart* and *On Glands*

<sup>7</sup> Thyroid gland extract and pituitary extract from the posterior lobe of the pituitary body of the sheep as well as ox-gall from bullocks have all been used in modern attempts at therapy of deficiency diseases. It may be that empirical observation led ancient doctors to make use of bile.

<sup>8</sup> Caius John, *De libris propriis / de libris suis* (London, Seresius: 1570) 90–93 *valde (ut nos putamus) dissipatum, jam (sed conjectura nostra) restitutum*. I am grateful for this reference to Professor Vivian Nutton.

ought to be read consecutively as a single work with a common overarching title *On Anatomy*. He placed much emphasis on an apparently transitional expression at the end of *On the Heart* ('let such be said on the heart') and an apparently recapitulating expression at the beginning of *On Glands* ('on glands as a whole this is the situation'). This argument on the basis of common content and expression is impressively ahead of its time, though here surely misapplied.

The work was clearly available, and medical writers familiar with Hippocratic texts came to cite it, along with others. However, the passages most commonly cited relate neither to the general anatomy and physiology of glands nor to the nature of lymphatic fluid, but rather to the question of bodily flux and in particular the part attributed to the brain in this. The fundamental Hippocratic theory that disease arose as the result of a flux of noxious matter (commonly phlegm and commonly believed to originate in rising digestive residues) which rose to the head and then flowed from the head to various points in the body – for instance, to eyes, ears, nose, chest, belly, back, hips – was expressed in many works as well as *On Glands*, which gives an account very close to that in *Places in Man*. This theory was the subject of many Renaissance works, commonly entitled 'on downward flux' or 'on downward fluxes' *De catarrho* or *De catarrhis*. In a lively ongoing debate, belief in flux from the head, with a corollary belief in the value of head-purgation, was upheld by some, primarily on the basis of ancient authority, and contested by others, primarily on the basis of anatomical impossibility.

Theories of the nature and motion of fluids in the body, both in health and in illness, had exercised the doctors of Antiquity. Humoral theory began with the Hippocratics, though it was less important and less consistent than has frequently been thought: more importance was attached to supposed directions of bodily flux than to postulated content. The possibility that the Hippocratics, who certainly knew something of the pulse and who expressed ideas of bodily circularity, knew and understood the circulation of the blood has been aired and, even quite recently, has had some advocates. The certainty that they knew and understood the lymphatic system has been overlooked. The difference between circulation in the blood vessels (a closed system of veins and arteries containing blood pumped by the heart) and flow in the lymph vessels (a system partially open, containing fluid moved in the main by muscular contraction) is enormous, but early modern discovery and understanding of the two systems followed somewhat parallel lines.

*Discoveries of Aselli and others*

Alongside William Harvey's great work on the circulation of the blood (1628) stands the work of Gaspare Aselli (born Cremona, died Milan; 1581–1625), published posthumously in 1627. Aselli described whitish vessels covering the intestine and mesentery of a dog he was dissecting: the lymphatic vessels in the mesentery (the lacteals) are most visible after a fatty meal when fat is transported as an emulsion to the liver and is white in colour (chyle). The progress of discovery in Antiquity was probably similar: as we have seen, the Hippocratic letters describe Democritean experiments on animals to ascertain the 'nature and place of bile', and Democritean thought underlies *On Glands*. The two animal species said to have been utilised by Democritus, dog and pig, were utilised also by early modern researchers. At that time, as in classical Antiquity, doctors were biological scientists. Aselli says nothing of Democritus or of *On Glands* though he does quote passages from Hippocrates, Aristotle and, especially, Galen (in his chapter 4). The Hippocratic passages cited are from *Diseases* 4 (though he questions whether this is truly Hippocratic; I have argued that it is by the same author as *On Glands*); also *On Flesh*, *Nutriments*, *Places in Man* and *Aphorisms*.

Others tried to replicate the experiments of Aselli and further discoveries followed: Jean Pecquet (born Dieppe, died Paris; 1622–1674) observed and described the thoracic duct and its orifice in the subclavian vein, a fundamental contribution to understanding the interconnections between lymph drainage and the circulation of the blood; the title given by Pecquet to his work, mentioning blood and chyle together, aptly encapsulates the significance of his discovery. Pecquet (in his *exercitatio* III) considers the route taken by chyle and attempts to relate this to the production of breast milk. In this he cites passages from Hippocrates and Aristotle. The Hippocratic passages cited include some from *Nature of the Child* and *Diseases of Women* (both regarded by me as by the author of *On Glands*); also from *Aphorisms* and *Epidemics*. Similarly, discussing ducts for lactation in his work of 1655, Anton Deusing (1612–1666) cites parallel passages of these same Hippocratic works.

*Interaction between philologists and scientists*

The interaction between philologists and scientists is well illustrated by the activities of Johannes van Horne (1621–1670) and Johannes Antonides

van der Linden (1609–1664), colleagues, collaborators and distinguished doctor-editors working in Leiden, a great international centre for anatomical research and scientific exchange. It was van Horne who first confirmed the presence of the thoracic duct in humans. Both van Horne and van der Linden knew the Hippocratic work *On Glands*, and both were familiar with contemporary research and discovery, but neither discussed the peculiar relevance of the former to the latter. *On Glands* had been noted in the significant work of Leonardo Botallo, meticulously edited with the addition of marginal summaries and an *index capitum* by van Horne.<sup>9</sup> Botallo quotes *On Glands* in an early expression of scepticism on the subject of flux theory: ‘since the fluxes, in turning to some part below the neck, are not sent down from the brain, as most people believe’.<sup>10</sup> In his note van Horne finds *On Glands* opaque and wonders ‘in what fashion that work is to be understood’,<sup>11</sup> but confines his discussion to the question of flux.

A magnificent *variorum* collection edited by van der Linden and published by Blaeu of Amsterdam comprises the seminal treatises of Aselli and of Harvey (third printing of Aselli’s, fifth of Harvey’s); also the brief but important letters of Walaëus (Jan de Wale, 1604–1649) in response to these; and in addition all the works of Spigelius (Adriaan van der Spiegel, 1578–1625), the longest being an anatomical study of the human body in ten books. In this van der Linden demonstrates a comprehensive and far-sighted recognition of the significance of contemporary discoveries. In addition to collecting and disseminating these works, van der Linden prepared a complete Hippocratic edition, brought out posthumously by his son in 1665. He was also a distinguished teacher and with his students did much to make the new science known and understood.<sup>12</sup>

Throughout van der Linden’s publications, Hippocratic texts are quoted reverentially and extensively.<sup>13</sup> However, he rarely cited *On Glands* and was

<sup>9</sup> Botallo Leonardo, *De catarrho* (Paris, Aldine: 1564), ed. Horne Johannes van, *Opera omnia medica et chirurgica Botalli* (Leiden, Gaasbeeck: 1660).

<sup>10</sup> Horne Johannes van, *Novus ductus chyliferus. Nunc primum descriptus et eruditorum examini expositus* (Leiden, Hackius: 1652) 431 ‘quod fluxiones, qua partem aliquam infra cervicem torquent, a cerebro non demittantur, ut plerique censent’.

<sup>11</sup> Van Horne, *Novus ductus chyliferus* 370 (ch. V), n. 1 ‘qua ratione ista tractio sit intelligenda’.

<sup>12</sup> The adverse judgment of Sarton, alleging that van der Linden was hostile and unresponsive to Harvey and others, is cogently contested and rebutted by Preiser: see Sarton G., “Johannes Antonides van der Linden (1609–1664)” in Underwood E.A. (ed.), *Science, Medicine and History* (Oxford: 1953) 14–20; Preiser G., “Zur Hippokratesauffassung des Johannes Antonides van der Linden”, *Medizinhistorisches Journal* 4 (1969) 305–315.

<sup>13</sup> Rothschild K.E., “Ein quantitatives Hilfsverfahren zur Charakterisierung medizinhistorischer Quellen (Autorenzitate)”, *Sudhoffs Archiv* 50 (1966) 259–266, surveys statistically the citation of ancient authors, including Hippocrates, in van der Linden (and others).



apparently unaware of the full significance of the work. Thus, in his ambitiously wide-ranging study of the body *medicina physiologica* he struggles with the section on intestinal glands, wondering whether the 'copious moisture present there' may refer to 'dropsy';<sup>14</sup> however, in his edition he makes no mention of this diagnosis and translates blandly, 'the intestines have rather large glands at the omentum'.<sup>15</sup> At the same time, the entries in his index under the heading *glandulae* are remarkably full and it is significant that there are several subheadings on the role of glands in flux; evidently, like his colleague van Horne and others, he placed emphasis on this limited aspect of the Hippocratic work. Similarly, Spigelius had treated glands in a section on the activity of the brain, regarding their universal function as devoted to the 'elimination of serous moisture'.<sup>16</sup>

Flux theory was most extensively contested in related works of 1660 and 1664 by Conrad Victor Schneider (1614–1680), with a battery of arguments based on his own demonstration that, although in skeletons the cribiform plate was perforated by numerous fine passages, in corpses its entire surface was covered by an impervious dura: thus, the concept of flux from the brain and with it the notion of treatment by purgation of the head was vitiated as 'all the routes of downward flux which Hippocrates invented are false'.<sup>17</sup> Discussion of flux theory was commonly allied with discussion of affections of the brain, such as apoplexia and melancholia. These play a significant part in *On Glands* also.

### *Comparative anatomy and further discoveries*

Through scrutiny of internal parts of animals and intensive study of comparative anatomy Olof Rudbeck (from Sweden, working in Padua; 1630–1702) and Thomas Bartholin (from Denmark, working in Leiden, Padua and Basel; 1616–1680) almost simultaneously succeeded in distinguishing the lymph vessels from the lacteals. Rudbeck's approach was primarily

<sup>14</sup> Linden Johannes Antonides van der, *Medicina physiologica* (Amsterdam, Ravestein: 1653) 60–61 'intestinae copioso humore abundant'.

<sup>15</sup> Linden Johannes Antonides van der, *Magni Hippocratis Coi opera omnia* (Leiden, Gaasbeeck: 1665) ad loc.: 'intestina [...] habent [...] glandulas in omentum maiores'.

<sup>16</sup> Linden Johannes Antonides van der, *Aselli, Harvey, Spigelius, Walaeus. Opera quae extant omnia ex recensione* (Amsterdam, Blaeu: 1645); Spigelius, ch. VIII 'De actione et usu cerebri' 296 'serosum humorem expurgationi'.

<sup>17</sup> Schneider Conrad Victor, *De catarrhis* (Wittenberg, Henckel: 1660 and 1664) 487 'omnes quas catarrhorum vias finxit Hippocrates sunt falsae'; Lower Richard, *De catarrhis* (London: 1672) made similar observations on the subject of nasal flux.

anatomical and Bartholin's more physiological in emphasis. Bartholin's title of the work published in 1652 *De lacteis thoracis in homine brutisque nuperrime observatis* ('On vessels very recently observed in man and beasts') shows clearly that he studied human anatomy in conjunction with that of other animals. Rudbeck's own account of his work records experiments on almost four hundred animals of different kinds: dogs, cats, calves, sheep, goats, wolves and foxes. In detailed notes, he keeps a meticulous record of the differences between these specimens and advises others how to use them. The illustrations appended to his work are of a dog's stomach. As noted above, Hippocratic writers were aware of the close resemblance between human and canine intestines, evidently through cutting up bodies; Democritus studied the reproductive system of dogs and pigs; Aristotle too conducted research on many animals. Conservative medical critics, foremost among them Jean Riolan the Younger (of Paris; 1577/1580–1657), argued against the downgrading of Hippocratic and Galenic views and tried to reconcile them with the new discoveries. Riolan was not a crank, but engaged in serious debate, conducting and communicating his own counter-experiments. Riolan advocated careful dissection and scrutiny of human cadavers and wrote with disparagement and irony of the 'canicides' for which Pecquet and others were responsible.<sup>18</sup>

A powerful advocate of comparative anatomy was Severinus (Marco Aurelio Severino, of Naples; 1580–1656): in an important work of 1645 which resembles *On Glands* in its view of the unity of nature he argued cogently for the structural and functional unity of all plant and animal life and gave detailed accounts of the different yet comparable internal organisation of many different species of mammals, including dogs, cats, sheep, pigs, hares and hedgehogs. Severinus suggested, perhaps heretically, that Hippocrates was in certain respects a pupil of Democritus, whose importance he fully appreciated: 'Hippocrates, as if taught by Democritus'.<sup>19</sup> But Severinus knew his Hippocratic texts: he refers to the comparative anatomy seen in *The Sacred Disease* (brain of ox) and *On Bones* (intestines of dog).

<sup>18</sup> See Mani N., "Jean Riolan II (1580–1657) and Medical Research", *Bulletin of the History of Medicine* 42 (1968) 121–144.

<sup>19</sup> Severinus Marcus Aurelius, *Zootomia Democritaea* (Nuremberg: 1645) 162 *Hippocrates quasi a Democrito edoctus*. See Schmitt C.B. – Webster C., "Harvey and M.A. Severino: A Neglected Medical Relationship", *Bulletin of the History of Medicine* 45 (1971) 49–75; also "Marco Aurelio Severino and his Relationship to William Harvey: some Preliminary Considerations" in Debus A.G. (ed.), *Science, Medicine and Society in the Renaissance* (New York: 1972) on the relationship between Severinus and his contemporaries, especially Harvey.

Guerner (Werner) Rolfinck (1599–1673) is almost a lone voice in relating *On Glands* to the new findings. In a work of 1652, he quotes the description of the head and accepts its role in disease-inducing flux, including especially melancholia. Though he writes about flux, he nevertheless relates the channels postulated in *On Glands* to the newly discovered lymphatic vessels: ‘now indeed the manner in which flux is generated is much clearer, since the discovery of new lymphatic vessels by Bartholin’.<sup>20</sup> Similarly, Johann Peyer (1653–1712) writing in a work of 1681 on the intestinal glands is unusual in declaring that these ‘did not escape the notice of Hippocrates, and I am not the first [...] the glands of the intestines were quite familiar to ancient anatomists’.<sup>21</sup> In England, the colleagues Thomas Wharton (1614–1673) and Francis Glisson (1597–1677) – through scrutiny of many different animals, including cats, dogs, rabbits, hares, mice and deer – greatly advanced understanding of the place of the glands in bodily function. In his study of the liver, Glisson made many pertinent observations based on his understanding of recent research on blood circulation and lymphatic function. He made suggestions about the function of bile (that old Democritean question), about the relation between chyle and blood (which he thought had no organic difference), about the composition of bile (defined as containing ‘sulphur, salt, water, earth’ and as being partly ‘watery or phlegmatic’); he offered brief explanations of the causes of such diseases as paralysis, phthisis and scrofula; he theorised about the composition of seminal fluid and about the relations between cerebral and spinal fluid. Glisson distinguished many different glands, and suggested that they fell into three types, for three purposes.<sup>22</sup> Although many of Glisson’s topics mesh with those of the Hippocratic work, he makes no mention of it. He must, however, have known it, as Wharton undoubtedly did.

Wharton’s title *Adenographia* is itself immediately suggestive of the Hippocratic model; and his ordering of topics follows it in outline, for instance concluding with the breasts. He explicitly cites *On Glands*, especially the

<sup>20</sup> Rolfinck Guerner, *Methodus cognoscendi et curandi adfectus capitis particulares* (Jena, Nisius: 1653) 14–15 ‘nunc vero modus generationis catarrhi multo evidentior est, inventis a Bartholino vasis lymphaticis novis’.

<sup>21</sup> Peyer Johann Conrad, *Parerga anatomica et medica* (Geneva-Amsterdam: 1681) 83 ‘(exercitatio II) non latuerunt Hippocratem nec primus ego sum [...] priscis anatomicis glandulas intestinorum omnino innotuisse’.

<sup>22</sup> Glisson Francis, *Anatomia hepatis. Cui praemittuntur quaedam ad rem anatomicam universe spectantia. Et ad calcem operis subjiciuntur nonnulla de lymphae-ductibus nuper repertis* (London, du-Gardianis: 1654) 198, 311, 343, 413, 424; also 438 composition of bile ‘spiritus, sulphur, sal, aqua, terra,’ being partly ‘aquea seu phlegmatica’; tripartite purpose of glands ‘ad excretionem, ad reductionem, ad nutritionem’.

passages relating to the brain, reaching the conclusion that the brain does not belong to the 'family' of glands; also the passage relating to the glands of the omentum, which he believes relates to the pancreas (not as Riolan thought to the intestines).<sup>23</sup> These two passages (on brain and on intestines) are cited in Wharton's 'list of chapters' (*elenchus capitum*). He further takes issue with Riolan, combating Riolan's acceptance of the Hippocratic statement that glands and hair have the same place and purpose: Wharton argues that as there are glands, but not hair, at elbows and knees there is no necessary association of the two.<sup>24</sup> Throughout, the views of Bartholin, Pecquet, van Horne and others are contested or refined; but there is most disagreement with Riolan. Thus, Wharton tacitly accepts the idiosyncratic account presented in *On Glands* of the function of the tonsils (that they are first to receive influxes of moisture from the brain) but rejects Riolan's view (that this occurs 'lest they descend to the lung') in favour of his own version in terms of producing saliva and enhancing taste.<sup>25</sup> In short, Wharton does engage with the Hippocratic text but he does so selectively and without appreciation of its overall significance.

### *Neglect of the ancient work. Possible explanations*

It seems that the main contentions of *On Glands* are neglected despite its vision and its clear relevance to the current discoveries relating to the lymphatic system. Other aspects of the work, highly relevant to ongoing debates, are similarly overlooked: it is fundamentally concerned with the nature, routes and contents (chyle, blood, milk) of all bodily ducts; it is based upon comparative anatomy; it raises questions of teleology or *usus*. In addition, the systemic diseases – markedly syphilis and consumption – rampant in the seventeenth century are similar to those familiar to the doctor of *On Glands*. Severinus himself in a work of 1632 had described the abscesses in syphilis, a systemic and glandular disease; Wharton was a physician in London at the time of the bubonic plague, 1665.

Some general reasons may be suggested for this neglect. Doctors read Hippocratic works primarily with a view to quarrying them for useful

<sup>23</sup> Wharton Thomas, *Adenographia* (London, Wharton: 1656), ch. III, especially at 10 (brain not in *glandularum familia*) and 65.

<sup>24</sup> Wharton, *Adenographia* 189.

<sup>25</sup> Wharton, *Adenographia*, ch. XXII, especially at 140 'cerebri humiditates [...] ne decurrant in pulmone'.

practical nuggets. *On Glands*, not being practically useful, is readily disregarded. The work is short and so easily overlooked; it is in places difficult; it lacks quotable quotes. The author's terminology of 'glands' and 'moisture' is on the one hand peculiar yet on the other hand general and so liable to go unrecognised. Its overarching approach might have been unappreciated in an era of increasing specialisation, when researchers tended to concentrate on the lung, the liver, the brain or other parts and so on the structure and function of particular glands, to the exclusion of the lymphatic system as a whole.<sup>26</sup> In addition, much debate on bile and chyle centred on the Galenic view of the liver, to which Hippocratic texts were not so relevant. Further, views of 'Hippocratic' (superior) and 'Democritean' (inferior) input may have militated against the work's being taken seriously.

Some more particular reasons may be suggested also. The absence of humoral theory, which was increasingly being accepted, and the presence of flux theory, which was increasingly being questioned, might have occasioned scepticism. (Paradoxically, flux theory at times conflicts in the treatise with the more sophisticated theory of glands – it may have been incorporated in the work through the author's loyalty to his early training.) The key section on intestinal glands is particularly compressed and difficult. It seems then that, though the work was known, this familiarity was restricted to the parts relating to flux from the head, and the related discussion of the brain: citation is selective. Although *On Glands* is incorporated by the Edinburgh physician Sir Thomas Burnet (1638–1704) in a medical thesaurus or compendium (*thesaurus medicinae*) published in 1685, in reality the Hippocratic résumé is very partial, confined to a summary of the section on the brain and the seven fluxes.

It seems probable that seventeenth-century writers were reliant on such second-hand reports, citations or summaries; that is, on the derivative compilations of others rather than on their own independent scrutiny of ancient texts. Paradoxically, the main thrust of *On Glands* was better appreciated in the sixteenth century, many years before the early

---

<sup>26</sup> In 1642, John Georg Wirsung discovered the pancreatic duct; in 1655 and 1660, Thomas Wharton discovered the ducts of the submaxillary gland and of the parotid; in 1662, Nicolas Steno discovered the ducts of the lachrymal gland and other glands of the mouth and nose. See Introduction to this volume, 6–7. On later debate between Herman Boerhaave (1668–1738) and Frederick Ruysch (1638–1731) on the nature of glandular function see Knoeff R., "Chemistry, Mechanics and the Making of Anatomical Knowledge: Boerhaave vs Ruysch on the Nature of the Glands", *Ambix* 53 (2006) 201–219.

modern discoveries were made. Foesius' notes, appended to his edition of the treatise, are disproportionately copious to its brevity and in addition he explicates many words from it in his *Oeconomia*. Among Foesius' percipient observations are these: the work 'has reference to the composition and structure of the body' and so ought to be included in Erotian's category 'works on bodily nature' (φυσικά); the word 'whole' (ὅλομελής) at the beginning refers to the 'the complete and all-embracing character of glands';<sup>27</sup> in addition, Foesius demonstrates awareness of parallels in content to the Hippocratic works *Generation* and *Nature of the Child*, and he cross-references Galen's work *On Seed*.

It is salutary to recall the slow speed of progress in this complex field. The functions of many glands remained unknown long after their anatomical structures were understood. In this slow progress, the Hippocratic *On Glands*, an important and visionary work, has been little cited and, when cited, not fully understood.

---

<sup>27</sup> Foesius Anutius, *Magni Hippocratis [...] opera omnia* (Frankfurt, Wechel: 1595), ad loc.: 'ad corporis compositionem et structuram spectat' and 'integra et absoluta glandulorum natura'.

### Selective bibliography

- ASELLI GASPARE, *De lactibus sive lacteis venis [...] dissertatio* (Milan, Bidellius: 1627).
- BARTHOLIN THOMAS, *De lacteis thoracis in homine brutisque nuperrime observatis* (Copenhagen, Martzan: 1652).
- , *Defensio vasorum lacteorum et lymphaticorum adversus Joannem Riolanum* (Copenhagen, Holst: 1655).
- , *Vasa lymphatica nuper in animantibus inventa et hepatis exsequiae* (Copenhagen, Hakius: 1653).
- BOTALLO LEONARDO, *De catarrho* (Paris, Aldine: 1564); see HORNE JOHANNES VAN.
- BURNET THOMAS, *Hippocrates contractus* (Edinburgh, Reid: 1685).
- CAIUS JOHN, *De libris propriis / de libris suis* (London, Seresius: 1570); ed. Roberts E.S.
- CALVUS MARCUS FABIVS, *Hippocratis Coi [...] octoginta volumina* (Rome, Minitius: 1525).
- CORNARIUS JANUS, *Hippocratis Coi medici [...] libri omnes* (Basel, Froben: 1538).
- CRAIK E.M., *Hippocrates Places in Man* (Oxford: 1998).
- , "[Hippocrates] On Glands", forthcoming in *Proceedings of Colloque International Hippocratique XIII* (held at Austin TX, 2008).
- , *The Hippocratic Treatise On Glands, Edited and Translated with Introduction and Commentary* (Leiden: 2009).
- CRIVELLATO E. – TRAVAN L. – RIBATTI D., "The Hippocratic Treatise 'On Glands': The First Document on Lymphoid Tissue and Lymph Nodes", *Leukemia* 21 (2007) 591–592.
- DEUSINGIUS ANTONIUS, *De motu cordis et sanguinis itemque de lacte* (Groningen, Bronckhorst: 1655).
- ERMERINS F.Z., *Hippocratis et aliorum medicorum veterum reliquiae* (Utrecht: 1859–1864).
- FOESIUS ANUTIUS, *Magni Hippocratis [...] opera omnia* (Frankfurt, Wechel: 1595).
- , *Oeconomia Hippocratis* (Frankfurt, Wechel: 1588).
- GLISSON FRANCIS, *Anatomia hepatis. Cui praemittuntur quaedam ad rem anatomicam univarse spectantia. Et ad calcem operis subjiciuntur nonnulla de lymphae-ductibus nuper repertis* (London, du-Gardianisu: 1654).
- , *Tractatus de ventriculo et intestinis* (Amsterdam-London, van Waesberge: 1677).
- GRENSEMANN H., *Hippokratische Gynäkologie. Die gynäkologischen Texte des Autors C nach den pseudohippokratischen Schriften de muliebribus I, II und de sterilibus* (Wiesbaden: 1982).
- , *Knidische Medizin, Teil I. Die Testimonien zur ältesten Knidischen Lehre und Analysen Knidischer Schriften im Corpus Hippocraticum*, *Ars Medica* Abt. 2, Gr.-Lat. Med. Bd. 4 (Berlin-New York: 1975).
- HARVEY WILLIAM, *De motu cordis et circulatione sanguinis* (Frankfurt, Fitzer: 1628).
- HORNE JOHANNES VAN, *Novus ductus chyliferus. Nunc primum descriptus et eruditorum examini expositus* (Leiden, Hackius: 1652).
- , *Opera omnia medica et chirurgica Botalli* (Leiden, Gaasbeeck: 1660).
- KEYNES G., *The Life of William Harvey* (Oxford: 1966).
- KNOEFF R., "Chemistry, Mechanics and the Making of Anatomical Knowledge: Boerhaave vs Ruysch on the Nature of the Glands", *Ambix* 53 (2006) 201–219.
- LINDEN JOHANNES ANTONIDES VAN DER, *Aselli, Harvey, Spigelius, Walaeus. Opera quae extant omnia ex recensione* (Amsterdam, Blaeu: 1645).
- , *Magni Hippocratis Coi opera omnia* (Leiden, Gaasbeeck: 1665).
- , *Medicina physiologica* (Amsterdam, Ravestein: 1653).
- LITTRÉ E., *Oeuvres complètes d'Hippocrate* (Paris: 1839–1861).
- LOWER RICHARD, *De catarrhis* (London: 1672).
- MANI N., "Jean Riolan II (1580–1657) and Medical Research", *Bulletin of the History of Medicine* 42 (1968) 121–144.
- NIELSEN A.E., "A Translation of Olof Rudbeck's *Nova Exercitatio Anatomica* announcing the Discovery of the Lymphatics (1653)", *Bulletin of the History of Medicine* 11 (1942) 304–339.



- PECQUET JEAN, *Experimenta nova anatomica* [...]. *Dissertatio anatomica de circulatione sanguinis et chyli motu* (Paris, Cramoisy: 1651).
- PEYER JOHANN CONRAD, *Parerga anatomica et medica* (Geneva-Amsterdam: 1681).
- PREISER G., "Zur Hippokratesauffassung des Johannes Antonides van der Linden", *Medizin-historisches Journal* 4 (1969) 305–315.
- RIOLAN JEAN, *Opuscula nova anatomica* (Paris, Meturas: 1653).
- ROLFINCK GUERNER, *Methodus cognoscendi et curandi adfectus capitis particulares* (Jena, Nisius: 1653).
- ROTHSCHUH K.E., "Ein quantitatives Hilfsverfahren zur Charakterisierung medizinhistorischer Quellen (Autorenzitate)", *Sudhoffs Archiv* 50 (1966) 259–266.
- RUDBECK OLOF, *Nova exercitatio anatomica, exhibens ductus hepaticos aquasos et vasa glandularum serosa* (Uppsala: 1653); see NIELSEN A.E.
- SARTON G., "Johannes Antonides van der Linden (1609–1664)" in Underwood E.A. (ed.), *Science, Medicine and History* (Oxford: 1953) 14–20.
- SCHMITT C.B. – WEBSTER C., "Harvey and M.A. Severino: A Neglected Medical Relationship", *Bulletin of the History of Medicine* 45 (1971) 49–75.
- , "Marco Aurelio Severino and his Relationship to William Harvey: some Preliminary Considerations" in Debus A.G. (ed.), *Science, Medicine and Society in the Renaissance* (New York: 1972).
- SCHNEIDER CONRAD VICTOR, *De catarrhis* (Wittenberg, Henckel: 1660 and 1664).
- SEVERINUS MARCUS AURELIUS, *Zootomia Democritaea* (Nuremberg: 1645).
- WALAEUS JOHANNES, *Epistulae duae de motu chyli et sanguinis* (Leiden: 1640); see LINDEN JOHANNES ANTONIDES VAN DER.
- WEAR A. – FRENCH R.K. – LONIE I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985).
- WHARTON THOMAS, *Adenographia* (London, Wharton: 1656).
- WILLIS THOMAS, *Cerebri anatome* (London, Roycroft: 1664).
- ZWINGER THEODOR, *Hippocratis Coi* [...] *viginti duo commentarii tabulis illustrata* (Basel, Episcopius: 1579).
- , *Physiologia medica* (Basel, ca. 1588; published posthumously Basel, Zwinger: 1610).

BETWEEN ATOMS AND HUMOURS.  
LUCRETIUS' DIDACTIC POETRY AS A MODEL OF INTEGRATED AND  
BIFOCAL PHYSIOLOGY

Fabio Tutrone

*Summary\**

Lucretius has often been regarded as one of the fathers of modern science, and also in recent years several studies have explored his influence far beyond a merely literary perspective. In this paper I analyse specifically the importance of the poet's 'eclectic' attitude in physiology from the point of view of his *Fortleben* in early modern thought. I suggest that the typical eclectic combination of physics and biology, atomism and macroscopy, which the *De rerum natura* shows in its didactic structure both through its images and even more through its conscious scientific reflection, built an attractive basis for attempts in the modern period at harmonising corpuscularian theories and qualitative doctrines. In order to appreciate this dialectic relationship I open with a discussion of Lucretius' own versatile use of vitalism and biology – referring especially to the Peripatetic tradition – and then go on to consider the influence of such a powerful model, which for the sake of argument is called *bifocal* and *integrative*, on sixteenth- and seventeenth-century authors like Fracastoro, Telesio and Bruno.

*A Latin ancestor for a modern revolution*

In the common imagery of our age, the so-called scientific revolution which took place in the Renaissance often coincides with a general rejection of ancient naturalistic notions. Aristotelianism and Ptolemaism were to be neglected and a properly *modern* scientific thought was to develop. This comfortable, simplistic pattern overshadows the basic fact that some ancient texts played a decisive role in the reflections of many Renaissance scientists. Their arguments frequently made appeal to Greek and Latin sources, since they regarded Antiquity as a stimulating collection of antagonistic models. It has been rightly pointed out, from a general perspective,

---

\* I am very grateful to the Fondation Hardt pour l'Étude de l'Antiquité Classique (Geneva) for the precious research scholarship it granted to me during the preparation of this article.

that each age used the classical cultures in a selective way, reinventing Antiquity for its own ideological purposes,<sup>1</sup> and a similar process can also be observed for early modern scientific debate. The case of Lucretius that I shall be discussing here can make a very significant contribution to our understanding of these problems. Here I will not dwell on Lucretius' importance in modern thought and his widespread glorification as a forerunner of recent scientific ideas. Several studies have recently focused on this theme, and it would be enough to read Albert Einstein's *Geleitwort* in Diels' edition to appreciate the kind of fascination this obscure figure could convey to refined scientific personalities.<sup>2</sup> Here, instead, I shall deliberately concentrate my attention on the problem of Lucretius' role in the acceptance of atomistic theories in sixteenth- and seventeenth-century physiology. What I would like to point out, in particular, is the relevance of Lucretian concepts and images in the modern elaboration of physiological models where mechanism and vitalism, biology and corpuscularianism, seem to be eclectically merged. I suggest that this sort of eclecticism, which is so typical of early modern atomistic ideas, could be also connected to the use of Lucretius' own versatile physiology.<sup>3</sup>

In his essay on the rise of atomism in the early seventeenth century Christoph Meinel listed the *De rerum natura* and its convincing imagery among the three main reasons for the success of modern corpuscularian theories.<sup>4</sup> The impact of the poem's didactic arguments on the scientific debate of this age is in fact huge and impressive. Sometimes even

<sup>1</sup> See the extensive discussion in Picone G. (ed.), *L'antichità dopo la modernità* (Palermo: 1999), and especially the paper by Romano E., "Fine di un mondo antico: Costruzione, ascesa e declino di un'invenzione moderna", in Picone (ed.), *L'antichità* 9–31.

<sup>2</sup> Cf. Einstein A. in Diels H. (ed.), *T. Lucretius Carus. De rerum natura. Lateinisch und Deutsch* (Berlin: 1924), vol. 2, VIa – VIb. On Lucretius' *Fortleben* in modern scientific thought see, for instance, the recent works by Beretta M., "Gli scienziati e l'edizione del *De rerum natura*", in Beretta M. – Citti F. (eds.), *Lucrezio, la natura e la scienza* (Florence: 2008) 177–224, and Johnson M. – Wilson C., "Lucretius and the History of Science" in Gillespie S. – Hardie Ph. (eds.), *The Cambridge Companion to Lucretius* (Cambridge: 2007) 131–148. Of course, I will quote and use other essays related to the same topic in this chapter.

<sup>3</sup> Although I am conscious of the fact that the term 'eclecticism' could sound ambiguous or generic in the discussion of specific scientific issues, I chose to employ it in this paper because of its intrinsic etymological meaning: I use it simply to refer to the inclination to combine different views or items in the framework of an organic theory.

<sup>4</sup> Meinel Ch., "Early Seventeenth-Century Atomism: Theory, Epistemology, and the Insufficiency of Experiment", *Isis* 79 (1988) 103, who discusses the diffusion of corpuscularianism 'despite the obvious lack of experimental support' and gives much importance to 'the persuasive appeal of the pictorial scheme supplied by Lucretius's poetic imagery, which offered an immediately convincing way of picturing material processes on the basis of everyday experience within the visible world'.

empirical remarks that are apparently drawn from direct observation, or are presented without any reference to sources, can be clearly traced back to Lucretius' poetry.<sup>5</sup> We can of course explain this practice as a typical expression of mannerist culture, as a way of arguing which still puts authorities and models in first place. But, as a model, Lucretius had probably much more to offer than his attractive imagery. It was not only a matter of poetry, rhetoric and persuasive appeal. There was also a keen physiological paradigm behind the lines of the poem, behind that picture of the world Western readers would continue to admire in the centuries to come. I believe the *De rerum natura* is a rare masterpiece of physiological synthesis. In its didactic structure we – like seventeenth-century scholars – can find a balanced mixture of *physics* and *biology*, macroscopy and microscopy. It is often said that Epicureanism founded a 'biological atomism',<sup>6</sup> but it has recently been correctly pointed out that this kind of eclectic orientation belongs instead to Lucretius' careful exposition. A short survey of some relevant scholarly reconstructions proposed in the last decades can perhaps help us in this field.

*A poet at the borderline. Lucretius between physics and biology*

In 1974 Pierre Grimal noticed a basic difference in the poem's scientific vocabulary, which would reflect a sort of 'double-levelled physiology': at an initial level Lucretius seems to analyse atoms and their movements, using the Latin terms *primordia*, *corpora* and *elementa* for these fundamental 'bricks' of nature; at a second level, however, the poet talks about *principia*, i.e. simple atomic aggregates which can be perceived and which compose, as natural elements, the visible objects of reality.<sup>7</sup> Thus between

<sup>5</sup> Some useful examples in Meinel, "Early Seventeenth-Century Atomism" 76–77, who deals with the 'arguments based upon extrapolations from macroscopic bodies' and states that 'the empirical facts referred to were *topoi* of the scholarly literature. Their aim was to appeal to the reader's erudition and imagination, rather than to his critical or experimental abilities. They belong to a literary tradition of figurative rhetoric, aimed at creating astonishment and, by means of astonishment, assent and persuasion'.

<sup>6</sup> See e.g. Beretta, "Gli scienziati e l'edizione" 218, who refers to J.A. Rochoux's appreciation for Epicureanism in the nineteenth century and to his attempt at taking back modern discoveries to 'Epicurus' and Lucretius' biological atomism'.

<sup>7</sup> See Grimal P., "*Elementa, primordia, principia* dans le poème de Lucrèce", in *Mélanges de philosophie, de littérature et d'histoire ancienne offerts à Pierre Boyancé* (Rome: 1974) 357–366. Of course, it is primarily compelling metrical reasons that influence the poet's choices, but it would be a mistake to think that this excludes any *ideological* background.

atoms and things there would be an intermediate stage comparable with the elements of Empedocles and Aristotle, the stage of *principia*.<sup>8</sup> That is the first point. Indeed, the history of ancient physiology has often been characterised by scholars in the context of a long struggle between two main orientations: the supporters of a continuous, alterable theory of matter, based on the study of biology and macroscopy, and the followers of corpuscularian doctrines. Jackie Pigeaud labelled these two trends with the names of '*vitalisme*' and '*mécanisme*'.<sup>9</sup> However, David Furley used the more direct terms of *Aristotelians* and *Atomists* (unifying under the first group 'Plato and Aristotle and their adherents').<sup>10</sup> And, more interestingly, Galen's treatise *On the Natural Faculties* clearly confirms this simplifying bipartition:

Now, speaking generally, there have been arisen the following two sects in medicine and philosophy among those who have made any definite pronouncement regarding Nature [...]. What, then, are these sects, and what are the logical consequences of their hypotheses? The one class supposes that all substance which is subject to genesis and destruction is at once

---

So, even if the lexical surface of the text sometimes seems generic, several specific passages (such as the ones Grimal analyses) reveal the conscious construction of a distinctive terminology.

<sup>8</sup> In this paper I will selectively focus on the problem of Aristotle's influence on Lucretius' biological culture from the point of view of the *Fortleben* of the poem. Therefore, I will not specifically discuss the question of Empedocles' relevance in *De rerum natura*, variously interpreted by the scholarly literature (see e.g. Furley D.J., "Variations on Themes from Empedocles in Lucretius' Proem", in id., *Cosmic Problems. Essays on Greek and Roman Philosophy of Nature* (Cambridge: 1989) 172–182, or D.N. Sedley's claims about Empedocles' 'poetical' influence on Lucretius in *Lucretius and the Transformation of Greek Wisdom* (Cambridge: 1998) 1–34). Nevertheless, it is important to recognise that Empedocles' natural philosophy and his wide biological reflection played a determinant role in many Lucretian passages dealing with biology. In a certain sense, his thought functioned as a model and a filter, even when refuted or not cited. See now M. Garani, *Empedocles Redivivus. Poetry and Analogy in Lucretius* (New York-Abingdon: 2007), on the presence of Empedoclean echoes in Lucretius' method and vocabulary. Garani also highlights the atomistic assimilation of Empedocles' four elements theory in the poem: Lucretius 'seems to suggest that while Empedocles' roots are not different in substance from any other mortal atomic combination, still they could be thought of as constituting the first stage in the creation of the world, from the microcosm upwards. In this spirit, Lucretius' poem is imbued with the Empedoclean fourfold division of the world in several of his descriptions' (14).

<sup>9</sup> Pigeaud J., "La physiologie de Lucrèce", *Revue des Études Latines* 58 (1980) 177. In this article I will use the English terms *mechanism* and *vitalism* giving them the same meaning Pigeaud gave to the corresponding French words.

<sup>10</sup> See Furley D.J., "Lucretius and the Stoics", *Bulletin of the Institute of Classical Studies of the University of London* 13 (1966) 31–32, who usefully sums up the gaps between the two traditions. Furley's collection of studies *Cosmic Problems* is extensively inspired by this division as well.

*continuous* and susceptible of *alteration*. The other school assumes substance to be unchangeable, unalterable, und subdivided into fine particles, which are separated from one another by empty spaces.<sup>11</sup>

Starting from this Galenic passage and recalling Grimal's observations, Pigeaud has carefully analysed Lucretius' position in such a context.<sup>12</sup> Seen as a whole, it is clear that our poet is a fervent adherent of mechanism: as an Epicurean, he considers matter unalterable, divided into atoms and interrupted by void. But, as Grimal noticed through his lexical study, this is only the first level of Lucretius' physiological perspective. Material *principles* of biological interest are necessarily involved in the constitution of objects and living beings, pure mechanism seeming unfit to describe the varied complexity of visible nature. That is why, in his analysis of the poem's physiological eclecticism, Pigeaud spoke about 'une physique à deux temps', supporting his thesis with precise notes on Lucretius' nutritional theory.<sup>13</sup> And before we move forward to the final step in our survey of scholarship, we can usefully appreciate this *bifocal* attitude to natural science by looking directly at Lucretius' psychological doctrine. In the third book of the *De rerum natura* (231–322) he explains the origin of different emotions and character in living beings through a physiological theory which neatly combines atomic materialism and humoral biology. According to Lucretius, four elementary substances, which are of course composed by atoms, regulate the psychic life of men and animals as *animalia*. They are heat (*calor* or *vapor*), wind (*ventus* or *aura*), air (*aer*) and a fourth unnamed element (*nominis expers*); they are all in any case

<sup>11</sup> Galenus, *De facultatibus naturalibus* 1.12 (2.27 K.) 'Καὶ αὐταὶ δύο γεγόνασιν αἰρέσεις κατὰ γένος ἐν ἱατρικῇ τε καὶ φιλοσοφίᾳ τῶν ἀποφνημαζένων τι περὶ φύσεως ἀνδρῶν [...]. Τίνας οὖν αἱ δύο αἰρέσεις αὐταὶ καὶ τίς ἡ τῶν ἐν αὐταῖς ὑποθέσεων ἀκολουθία; τὴν ὑποβεβλημένην οὐσίαν γενέσει καὶ φθορᾷ πᾶσαν ἡνωμένην θ' ἅμα καὶ ἀλλοιοῦσθαι δυναμένην ὑπέθετο θάτερον γένος τῆς αἰρέσεως, ἀμετάβλητον δὲ καὶ ἀναλλοίωτον καὶ κατατετμημένην εἰς λεπτὰ καὶ κεναῖς ταῖς μεταξὺ χώραις διειλημμένην ἢ λοιπῇ'.

<sup>12</sup> See Pigeaud, "La physiologie"; thorough remarks also in *ibidem*, *La maladie de l'âme. Étude sur la relation de l'âme et du corps dans la tradition médico-philosophique antique* (Paris: 1981) 196–211.

<sup>13</sup> Cf. Pigeaud, "La physiologie" 199, 'Être éclectique en physiologie, à l'époque de Lucrèce, ne signifie pas choisir, au gré du hasard et des goûts, telle ou telle étiologie ou description médicale. L'évolution de la physiologie, et notamment avec Asclépiade, paraît obliger un atomiste à un certain type de physiologie, disons anti-vitaliste ou mécaniste. La problématique est devenue plus nette, plus contraignante. L'on se trouve place devant certaines exigences théoriques. Être éclectique signifie adopter des solutions de deux types, combiner le vitalisme au mécanisme. Cela peut impliquer un refus de choisir, à propos d'un même problème, en faisant coexister les deux types d'explication'.

*principia* made by *primordia*, biological principles of a corpuscular nature.<sup>14</sup> The temporary predominance of each element gives rise to the different feelings of individuals: anger is produced by heat, fear by wind, peace by air, while the fourth substance has a coordinating function, allowing sensory perception. In a similar way, the usual prevalence of one of the first three elements is the origin of what we call temperaments or character: irascibility, fearfulness, placidness. It is quite evident that here Lucretius' doctrine gives some long-lasting vitalistic concepts an atomistic basis. The well-known Hippocratic theory of humours, as well as the Empedoclean-Aristotelian view of elements, can be clearly identified in the poet's scientific background. One can question, of course, how much of this doctrine dates back to historical Epicurean sources and how much, instead, has a more recent or even Lucretian origin, although several texts seem to confirm a genuine Epicurean ancestry.<sup>15</sup> Certainly an eclectic attitude towards physiology was already typical of Epicurus himself; many studies have rightly remarked on his ideological dialogue with the Peripatetic tradition.<sup>16</sup> Looking at Lucretius' synthesis and its importance for modern science, it is clear that this kind of eclecticism took a further relevant step with the *De rerum natura* and its didactic arrangement. And, more

<sup>14</sup> See especially 3.262–265, where the expression *primordia principiorum* (262), which cannot be explained with metrical arguments alone, openly highlights this gradual view. Cf. Grimal, "*Elementa, primordia, principia*" 357–358 'nous sommes en présence de trois ordres: les atomes, invisibles, extrêmement petits, durs, insécables, puis des substances "élémentaires", une sorte de vent (*aura*), de la chaleur (*vapor*), de l'air (*aer*) et la "quatrième nature", enfin, l'ensemble ainsi constitué est, par lui-même une "*natura*", un être particulier'.

<sup>15</sup> Cf. Epicurus, *Epistulae* 2.63; Plutarchus, *Adversus Colotem* 1118D–E; Aëtius, *Placita* 4.3.11; Macrobius, *Commentarium in somnium Scipionis* 1.14.20. See Usener H., *Epicurea* (Leipzig: 1887) 218. The commentary by Ernout A. – Robin L., *Lucrèce, De rerum natura. Commentaire exégétique et critique* (Paris: 1925–1928), vol. 2, 41–51 annotates verses 282–306 as follows: 'il y a dans ce passage un effort curieux pour déterminer, par la proportion des éléments dans le mélange constitutif de l'âme, non seulement les caractères humains, mais même le "comportement" psychologique de tout être vivant. C'est une transposition et une extension de la vieille théorie hippocratique des quatre humeurs, qui se rattache elle-même aux idées d'Alcméon et des Pythagoriciens sur l'harmonie des contraires comme base d'une vie corporelle normale. Mais, tandis que le caractère est ainsi l'effet du "tempérament" du corps (cf. Pl. *Ti.* 86e f.), pour l'Épicurisme il résulte du "tempérament" de l'âme, matérielle comme le corps' (48). This part of the passage will be discussed in detail shortly.

<sup>16</sup> A rich survey of the extensive scholarly literature dealing with this problematic relationship has been undertaken by Gigante M., *Kepos e Peripatos. Contributo alla storia dell'aristotelismo antico* (Naples: 1999) esp. 33–56. See also the works by Diano C., *Scritti Epicurei* (Florence: 1974) 129–280 and Mansfeld J., "Epicurus Peripateticus", in Alberti A. (ed.), *Realtà e ragione. Studi di filosofia antica* (Florence: 1994) 29–47, referring back to Gigante for other bibliographical items.



generally, when the seventeenth-century readers thought of Epicureanism, they saw Lucretius as their main source, together with Diogenes Laertius, focusing more on concrete information than on the history of the school. So we should analyse more fully which sort of *Naturwissenschaft* early modern scientists regarded as Epicurean, and imitated as such.<sup>17</sup> The exposition of Epicurus' psychophysiological theory, traces of which can already be seen in the *Epistle to Herodotus*,<sup>18</sup> acquires vivid *biological* evidence with Lucretius, since in the poem some lively zoological *exempla* are used to confirm this theory. None of the texts listed by Usener on the same matter of doctrine share such a striking wealth of naturalistic images.<sup>19</sup> But let us see how the poet describes the stable presence of different character in animals according to this view of the soul:

[...] the mind possesses that heat too, which it dons when it boils with rage, and the fire flashes more keenly from the eyes. Much cold breath too it has, which goes along with fear, and starts a shuddering in the limbs and stirs the whole frame. And it has too that condition of peaceful air which comes to pass when the breast is calm and the face unruffled. But those creatures have more of heat, whose fiery heart and passionate mind easily boil up in anger. Foremost in this class is the fierce force of lions, who often as they groan break their hearts with roaring, and cannot contain in their breast the billows of their wrath. But the cold heart of deer is more full of wind, and more quickly it rouses the chilly breath in its flesh, which makes a shuddering motion start in the limbs. But the nature of oxen draws its life rather from calm air, nor ever is the smoking torch of anger set to it to rouse it overmuch, suffusing in it the shadow of murky mist, nor is it pierced and frozen by the chill shafts of fear: it has its place midway between the two, the deer and the raging lions. So is it with the race of men.<sup>20</sup>

<sup>17</sup> We need only recall Pierre Gassendi's extensive use of Lucretius in the *Animadversiones* (1649) and the *Syntagma philosophicum* (1658): in these monumental works almost all the poem features as a pure testimony to Epicurean philosophy. See Wolff E., "L'utilisation du texte de Lucrèce par Gassendi dans le *Philosophiae Epicuri Syntagma*, in Poignault R. (ed.), *Présence de Lucrèce. Actes du colloque tenu à Tours (3–5 décembre 1998)* (Tours: 1999) 327–336 and Beretta, "Gli scienziati e l'edizione" 192–196. Beretta maintains that in Gassendi 'la lettura di Lucrezio era comunque strumentale alla piena comprensione e riabilitazione della filosofia di Epicuro ed è per questa ragione che Gassendi decise di smembrare i versi del *De rerum natura* adattandoli alla tripartizione epicurea della filosofia in canonica, fisica ed etica. Quello che è sfuggito agli studiosi è che nella sua meticolosa ed eruditissima opera di ricostruzione, Gassendi di fatto utilizzò quasi tutto il *De rerum natura* e che la *Vita* del 1649 e, in misura leggermente inferiore, la versione ampliata e modificata del 1658, possono essere considerate delle vere e proprie edizioni critiche del poema lucreziano' (193).

<sup>18</sup> See above, n. 15.

<sup>19</sup> Cf. Usener, *Epicurea* 216–219.

<sup>20</sup> Lucretius, *De rerum natura* 3.288–307 'Est etiam calor ille animo, quem sumit, in ira | cum fervescit et ex oculis micat acrius ardor. | Est et frigida multa comes formidinis aura | quae

Epicurus had surely glanced at humoral theories when he conceived his materialistic psychology.<sup>21</sup> But it has been noted that, in its commonly accepted reconstruction, Epicurus' treatise *On Nature* shows no trace of biological interest.<sup>22</sup> In terms of the theme of the present chapter, this is of course intriguing, since according to David Sedley's thesis Lucretius closely followed his master's work as 'his sole philosophical source and inspiration'.<sup>23</sup> Indeed, in the passage from *De rerum natura* cited above, Epicurus' fruitful dialogue with the Peripatetic tradition seems to be improved through the conscious *integration* of ethological material. It is well-known that ethology was a relevant part of Peripatetic biology, and so it is no accident that Piet Schrijvers identified in an unembellished passage of Aristotle's *History of Animals* the original source of this Lucretian argument.<sup>24</sup> Here, as well as in other parts of the poem,<sup>25</sup> Lucretius refers to what Schrijvers defines as 'un texte de base sur le caractères des animaux', a rich

---

ciet horrorem membris et concitat artus. | Est etiam quoque pacati status aeris ille, | pectore tranquillo qui fit vultuque sereno. | Sed calidi plus est illis quibus acria corda | iracundaque mens facile effervescit in ira. | Quo genere in primis vis est violenta leonum, | pectora qui fremitu rumpunt plerumque gementes | nec capere irarum fluctus in pectore possunt. | At ventosa magis cervorum frigida mens est | et gelidas citius per viscera concitat auras | quae tremulum faciunt membris existere motum. | At natura boum placido magis aere vivit, | nec nimis irai fax umquam subdita percit | fumida, suffundens caecae caliginis umbra, | nec gelidis torpet telis perfixa pavoris: | interutrasque sitast, cervos saevosque leones. | Sic hominum genus est'.

<sup>21</sup> See especially Diano, *Scritti Epicurei* 129–280, who highlights Epicurus' dependence on Aristotle.

<sup>22</sup> See Schrijvers P.H., *Lucrèce et les sciences de la vie* (Leiden-Boston-Cologne: 1999) 46, 'notre impression provisoire selon laquelle le grand nombre de thèmes et de concepts biologiques dans le *DRN* est plutôt une contribution personnelle et originale par Lucrèce à l'élaboration de la doctrine de son Maître, est renforcée par l'absence totale de thèmes biologiques dans la reconstruction du *Peri phuseôs* d'Epicure, telle qu'elle a été proposée par D. Sedley et généralement reprise par M. Erler dans le grand volume *Die Philosophie der Antike 4, Die hellenistische Philosophie 1*'. (Cf. Erler M., "Epikur" in Flashar H. (ed.), *Grundriss der Geschichte der Philosophie (begr. v. F. Überweg), Die Philosophie der Antike 4, Die Hellenistische Philosophie 1* (Basel: 1994) 94–103). Epicurus' *On Nature* is notoriously very fragmentary at present, so should be used with caution. Scholarship of the last few decades has nevertheless given us a clearer view of this treatise.

<sup>23</sup> See Sedley, *Lucretius* 93 (this argument is extensively supported at 134–165).

<sup>24</sup> See Schrijvers, *Lucrèce et les sciences* 51–54. Here I will discuss some connections between Lucretius and Peripatetic thought from the point of view of *biological* knowledge. Of course, this complex relationship concerns a much wider range of scientific themes and has been explored by other specific studies. See especially Furlley, "Lucretius and the Stoics", who pays particular attention to Lucretius' attacks on Peripatetic cosmology, and Sedley, *Lucretius* 166–185, who acutely identifies Theophrastus' imprint in the *De rerum natura*.

<sup>25</sup> Cf. *Lucr.* 3.741–753 and 5.855–867.

zoological repertory which could have been known by Hellenistic and Roman writers both in direct and indirect forms:<sup>26</sup>

Now here are the sorts of ways in which animals differ from each other in regard to disposition. Some are gentle, and sluggish, and not inclined to be aggressive, *e.g.*, the ox; others are ferocious, aggressive and stubborn, *e.g.*, the wild boar; some are intelligent and timid, *e.g.*, the deer and the hare; others are mean and scheming, *e.g.*, serpents; others are noble and brave and high-bred, *e.g.*, the lion; others are thorough-bred, wild and scheming, *e.g.*, the wolf [...]. The only animal which is deliberative is *man*. Many animals have the power of memory and can be trained; but the only one which can recall past events at will is *man*.<sup>27</sup>

Aristotle's long but lapidary catalogue – or its doxographical transposition – offered a wide range of animal *ethê*. Lucretius, conscious that he cannot deal with each temperament,<sup>28</sup> chooses from among them and revitalises his models through a wise poetic operation. The original anthropocentric

<sup>26</sup> *Compendia, résumés and excerpts* of Peripatetic biological works must have been quite common in the Hellenistic-Roman age. Theophrastus took excerpts from Aristotle's writings related to this topic, and Aristophanes of Byzantium wrote a very successful epitome of them; it is likely that this practice continued in the following centuries, since the use of Peripatetic biology made by Roman authors in their works often shows a selective, doxographic character (see Düring I., "Notes on the history of the transmission of Aristotle's writings", *Acta Universitatis Gotoburgensis* 56, 3 (1950) 35–70 and Barnes J., "Roman Aristotle", in Griffin M. – Barnes J. (eds.), *Philosophia togata II. Plato and Aristotle at Rome* (Oxford: 1999) 1–69). Nonetheless, the original text of treatises like the *Historia* was probably still available in that period, although practical and intellectual reasons make frequent use of it unlikely. I specifically dealt with this problem in my two papers "Lucrezio e la biologia di Aristotele: riflessioni sulla presenza dell'opera aristotelica nel *De rerum natura* e nella cultura greco-latina del I secolo a. C.", *Bollettino della Fondazione Nazionale "Vito Fazio Allmayer"* 35, 1–2 (2006) 65–104; "Libraries and Intellectual Debates in the Late Republic: The Case of the Aristotelian Corpus", in König J. – Oikonomopoulou K. – Woolf G. (eds.), *Ancient Libraries* (Cambridge University Press: forthcoming).

<sup>27</sup> Aristoteles, *Historia animalium* 1.1, 488b12–27 (my emphasis) 'Διαφέρουσι δὲ καὶ ταῖς τοιαῖσδε διαφοραῖς κατὰ τὸ ἦθος. Τὰ μὲν γάρ ἐστι πρᾶα καὶ δυσσθυμα καὶ οὐκ ἐνστατικά, οἷον βοῦς, τὰ δὲ θυμώδη καὶ ἐνστατικά καὶ ἀμαθῆ, οἷον ὕς ἄγριος, τὰ δὲ φρόνιμα καὶ δειλά, οἷον ἔλαφος, θασύπους, τὰ δ' ἀνελεύθερα καὶ ἐπίβουλα, οἷον οἱ ὄφεις, τὰ δ' ἐλευθέρια καὶ ἀνδρεία καὶ εὐγενή, οἷον λέων, τὰ δὲ γενναῖα καὶ ἄγρια καὶ ἐπίβουλα, οἷον λύκος' [...]. Βουλευτικὸν δὲ μόνον ἀνθρωπὸς ἐστὶ τῶν ζώων. Καὶ μνήμης μὲν καὶ διδασχῆς πολλὰ κοινῶναι, ἀναμνησθεσθαι δ' οὐδὲν ἄλλο δύναται πλὴν ἄνθρωπος'.

<sup>28</sup> Cf. Lucr. 3.314–318 'inque aliis rebus multis differre necessest | naturas hominum varias moresque sequaces; | quorum ego nunc nequeo caecas exponere causas | nec reperire figurarum tot nomina quot sunt | principiis, unde haec oritur variantia rerum.' Nonetheless, as I said (see n. 25), the poet recalls other examples of the same zoological catalogue in other circumstances. Moreover, in this specific passage he employs again the technical term *principiis* (318) according to the physiological bipartition discussed above.

perspective of the Peripatetic text<sup>29</sup> is also revised from a materialistic-Epicurean point of view, since the privilege of human memory is no longer remarked on in the poem's adaptation, where we find instead a simple equalisation of men and animals (*sic hominum genus est*, 307).<sup>30</sup> In the following lines (307–322) Lucretius merely highlights the fact that, despite the influence of their underlying natural disposition, which education cannot remove, men are able to live a life worthy of the gods, thanks to their capacity to reason. In a very Epicurean way, the power of nature is reaffirmed against any idea of physical-cosmological privilege and Epicurus' word is praised as a concrete possibility of elevation for human rationality.

What we can observe in this textual example is, I think, a valuable example of physiological eclecticism: visible and invisible phenomena, physics and biology, atomism and ethology, are carefully combined in order to construct a balanced model of *integrated* and *bifocal* physiology. An Aristotelian-flavoured imagery, which is more generally connected to the ancient tradition of physiognomy, is used to explain the corpuscularian truths Epicureanism has disclosed. Consequently Lucretius, the main source for modern age corpuscularianism, appears to be at the crossroads between two determinant orientations of scientific history. Moreover, the kind of intellectual operation we noticed here in the third book of the *De rerum natura* is not an isolated case. A further example among many other possibilities<sup>31</sup> would be from the fourth book of Lucretius' didactic work, where the poet expounds Epicurus' view on dreams and their physiological origin.<sup>32</sup> From a cognitive perspective, dreams are said to be the

<sup>29</sup> Aristotle's anthropocentrism in natural philosophy is discussed intensively in scholarly literature. While it is my opinion that passages like this from the *Historia* betray an intimate anthropocentric attitude in Aristotle's biology, I cannot deal here with the details of such a complicated problem. Johnson M.R., *Aristotle on Teleology* (Oxford: 2005) argued against any interpretation of Aristotle's teleology in terms of anthropocentrism, but Vegetti M., *Il coltello e lo stilo* (Milan: 1996<sup>3</sup>) showed that even the concepts of natural end and intrinsic potentiality draw a 'pyramid-shaped', anthropocentric picture of the natural world in Aristotle's science. Regardless of any refusal of providential schemes, 'normotypes' – and especially *one* human 'normotype' – remain at the centre of the Aristotelian account for physical reality.

<sup>30</sup> Schrijvers, *Lucrèce et les sciences* 53, says that 'la notice sur l'homme (βουλευτικὸν δὲ μόνον ἀνθρωπὸς ἐστὶ τῶν ζώων) a été tournée en une affirmation finale d'ordre éthique et protreptique, conformément à la tendance générale du *De rerum natura*'. However, I also see a subtle ideological shift in the transition from Aristotle to the Latin poet.

<sup>31</sup> A wider list of parallels between Lucretian and Peripatetic texts concerning biology can be found in my "Lucrezio e la biologia di Aristotele" 70–71.

<sup>32</sup> Lucr. 4.962–1036.

result of persisting stimulations of the atoms during the night, so that each individual – both men and animals as *animalia*, beings endowed with a soul – re-experiences their usual daily activities while sleeping. According to this theory, the perceptive particles (*simulacra*) which real objects emit by day and address to the sensory organs continue to influence the body's cognitive life, producing those illusory visions we call dreams. Epicurus, as far as we can see, had developed his explanation with a particular polemic reference to oneirocriticism and its religious background.<sup>33</sup> Lucretius, of course, assimilates this perspective, but supports his atomic argument with lively *biological* examples. Indeed, a whole gallery of dream types is displayed in the poem's section on this topic, and the most interesting part of it is perhaps condensed in the lines dealing with animals' dreams:

So exceeding great is the import of zeal and pleasure, and the tasks wherein not only men are wont to spend their efforts, but even every living animal. In truth you will see strong horses, when their limbs are lain to rest, yet sweat in their sleep, and pant for ever, and strain every nerve as though for victory, or else as though the barriers were opened (struggle to start). And hunters' dogs often in their soft sleep yet suddenly toss their legs, and all at once give tongue, and again and again snuff the air with their nostrils, as if they had found and were following the tracks of wild beasts; yea, roused from slumber they often pursue empty images of stags, as though they saw them in eager flight, until they shake off the delusion and return to themselves. But the fawning brood of pups brought up in the house, in a moment shake their body and lift it from the ground, just as if they beheld unknown forms and faces. And the wilder any breed may be, the more must it needs rage in its sleep. But the diverse tribes of birds fly off, and on a sudden in the night time trouble the peace of the groves of the gods with the whirl of wings, if in their gentle sleep they have seen hawks, flying in pursuit, offer fight and battle.<sup>34</sup>

<sup>33</sup> See esp. Epicur. *Sent. Vat.* 24. Other testimonies on the Epicurean reflections about sleep and dreams are collected in Usener, *Epicurea* 224–225. It is evident, however, that an enormous distance divides Lucretius' vivid account from these prosaic remains.

<sup>34</sup> Lucr. 4.984–1010 'Usque adeo magni refert studium atque voluptas, | et quibus in rebus conseruere esse operati | non homines solum sed vero animalia cuncta. | Quippe videbis equos fortis, cum membra iacebunt, | in somnis sudare tamen spirareque semper | et quasi de palma summas contendere viris | aut quasi carceribus patefactis †saepe quiete† | venantumque canes in molli saepe quiete | iactant crura tamen subito vocesque repente | mittunt et crebro redducunt naribus auras, | ut vestigia si teneant inventa ferarum, | expergefactique sequuntur inania saepe | cervorum simulacra, fugae quasi dedita cernant, | donec discussis redeant erroribus ad se. | At consueta domi catulorum blanda propago | discutere et corpus de terra corripere instant | proinde quasi ignotas facies atque ora tuantur. | Et quo quaeque magis sunt aspera seminiorum, | tam magis in somnis eadem saevire necessum. | At variae fugiunt volucres pinnisque repente | sollicitant divum nocturno tempore lusus, | accipitres somno in leni si proelia pugnas | edere sunt persectantes visaeque volantes'.

The poet's interest in ethology, and particularly in zoopsychology, comes out very clearly from this passage.<sup>35</sup> Epicurus' mechanistic approach to the physiology of dreams lies firmly behind Lucretius' teaching; but all the probative poetic material we find here seems to be derived from a secondary plane of *integration*. It could make sense to put this down to the author's careful observations, but from a cultural-historical point of view things are actually more complicated. Indeed, as in the text of the third book we have already examined, a highly educated background can be suggested for this zoological account. In particular, Aristotle's *History of Animals* (or some doxographical adaptation of it)<sup>36</sup> is a relevant point of reference for our passage. In his descriptive work Aristotle had specifically remarked on the fact that some animals dream:

Sleeping and waking in animals. All animals that are footed and blooded sleep and wake: this is plain to observation. Thus, all animals that have eyelids close them when they go to sleep. Furthermore, it appears that not only men, but *horses, dogs and oxen*, dream, indeed sheep too, and goats and the whole group of viviparous quadrupeds. Dogs betray the fact by *barking* while asleep. As for the *Ovipara*, it is not clear whether they dream, but it is obvious that they sleep.<sup>37</sup>

This is an important source for Roman zoological knowledge. Pliny the Elder translated it faithfully in his monumental treatise.<sup>38</sup> Lucretius seems to extend Aristotle's observations more widely. Some details, therefore, are rearranged, for example the demonstrative wording 'not only men but [...] or the reference to dogs' barking as well as to horses, while in general the Epicurean poet draws an original picture of ethological brilliance. It is particularly interesting to point out that Lucretius' argument concerning bird dreams (1007–1010) openly goes further than Aristotle's scepticism

<sup>35</sup> On the interest shown by the Epicurean school, and especially by Lucretius and Philodemus, in zoopsychology see Dierauer U., *Tier und Mensch im Denken der Antike* (Amsterdam: 1977) 194–198.

<sup>36</sup> See above n. 26.

<sup>37</sup> Arist. *HA* 4.10, 536b24–32 (my emphasis). 'Περὶ δ' ὕπνου καὶ ἐγρηγόρσεως τῶν ζώων, ὅτι μὲν ὅσα πεζὰ καὶ ἑναίμα πάντα καθεύδει καὶ ἐγρήγορεν, φανερόν ποιοῦσι κατὰ τὴν αἴσθησιν. Πάντα γὰρ ὅσα ἔχει βλεφαρίδας, μύοντα ποιεῖται τὸν ὕπνον. Ἐτι δ' ἐνυπνιάζειν φαίνονται οὐ μόνον ἄνθρωποι, ἀλλὰ καὶ ἵπποι καὶ κύνες καὶ βόες, ἔτι δὲ πρόβατα καὶ αἶγες καὶ πᾶν τὸ τῶν ζωοτόκων καὶ τετραπόδων γένος· δηλοῦσι δ' οἱ κύνες τῷ ὕλαγμῳ. Περὶ δὲ τῶν ψοτοκούντων τοῦτο μὲν ἄδηλον, ὅτι δὲ καθεύδουσι, φανερόν'.

<sup>38</sup> Cf. Plinius, *Naturalis Historia* 10.98.212. On this topic see Schrijvers, *Lucrèce et les sciences* 159–160, who highlighted the link between Lucretius and Aristotle in this regard, and Goguy D., *Les animaux dans la mentalité romaine* (Brussels: 2003) 92–94.



about ovipara.<sup>39</sup> Moreover, in terms of our present specific interest, it is evident that the Latin poem contains a careful combination of physical gnoseology and biological analysis. The Peripatetic disposition towards macroscopy, ethology and taxonomic framing joins the Epicurean reflection on corpuscles and physiological mechanisms. We could perhaps say that Lucretius, despite his strictly orthodox adherence to Epicurus' words, manages to adjust the rigidity of atomism with an alluring appeal to naturalistic evidence, to vitalistic immediacy. This is undoubtedly a matter of method, not merely of poetry and rhetoric. Over the years several scholars have rightly stressed the importance of Lucretius' *analogical* model as a development of Epicurus' empiristic approach to science.<sup>40</sup> Such a skilled development, with all its theoretical implications, went on to play a decisive role for the success of modern age corpuscularianism. Here I would like to emphasise that the influence of Lucretius on early modern scientists, on the so-called scientific revolution, cannot be fully appreciated if we do not consider this particular *bifocal* attitude shown by the poet in his naturalistic culture. In other words, it was remarkably easy to integrate Lucretius' propositions to form eclectic scientific models which combined atomism and macroscopy, since an effort of methodological integration had already been made by Lucretius himself.

---

<sup>39</sup> Pliny, of course, in his paraphrastic transposition simply reproduced Aristotle's uncertainty. Cf. Goguet, *Les animaux* 93.

<sup>40</sup> See Asmis E., *Epicurus' Scientific Method* (Ithaca-London: 1984), who discusses the kind of evolution Epicurus' method experienced during the history of Epicureanism: 'in the second and first centuries BC, some followers of Epicurus, as attested by Philodemus, defended the coherence of Epicurus' method of inquiry by interpreting the method as a whole as an inductive method, arguing that all valid scientific inferences are ultimately inductions [...]. Lucretius' use of induction suggests that he knew of the current controversy on induction and was a staunch defender of it, and that he may even have agreed that all of Epicurus' doctrines may be formulated as inductions. In general, however, Lucretius' choice of proof seems to reflect Epicurus' own preferences: counterwitnessing predominates in Lucretius' presentation of the fundamental theories, and induction becomes important in the more specialized theories' (336). On this peculiar use of inductive analogies in the poem's didactic technique see also Schrijvers P.H., "Le regard sur l'invisible: Étude sur l'emploi de l'analogie dans l'œuvre de Lucrèce", in Gigon O. (ed.), *Lucrèce. XXIV Entretiens Hardt sur l'Antiquité Classique* (Geneva: 1978) 77–121, who remarks on the importance of biological knowledge in this kind of argument, and Schiesaro A., *Simulacrum et imago. Gli argomenti analogici nel De rerum natura* (Pisa: 1990), who points out many relevant epistemological items; now also Garani, *Empedocles Redivivus*, highlighting Lucretius' dependence on Empedocles.



*The discrete charm of eclecticism. Lucretius and early modern physiology*

It is clear that the first revivals of corpuscularianism in the sixteenth and seventeenth centuries, cautious or hybrid as they were, frequently involved a strong dose of eclecticism. Aristotelianism was still an influential authority in every field of cosmological knowledge; while corpuscular views of nature, traced back to Democritus, Leucippus or Epicurus, quickly spread over Europe, it still made more sense to adapt and reshape the new trends in accordance with pre-existing physical and metaphysical concepts. We can observe such a harmonising attitude in many famous naturalists of this period. In his treatise *On the Sympathy and Antipathy of Things* (1545), for instance, the Veronese humanist and physician Girolamo Fracastoro openly evoked Democritus, Epicurus and Lucretius as reliable sources to understand magnetism:

The Ancients, such as Democritus and Epicurus, who were followed among our authors by Lucretius, thought that the origin of that attraction lay in the effusions of bodies they called atoms; and these effusions, as we will show in a while, cannot be denied, although the way ancient philosophers described them was quite rough and inept. Since this description is refuted in a sufficiently open way by Alexander of Aphrodisias and Galen, I will omit it. Nonetheless, once we accepted the doctrine of the effusion of atoms, it seems to me we can describe another way in which the attraction of similar substances occurs: but it is necessary to remember what I said above about the harmony and the movement of parts in a whole.<sup>41</sup>

The Epicurean theory of *eidola* or *simulacra* we encountered in Lucretius' account of the origin of dreams – a theory which was used by the Epicureans in order to explain every kind of interaction at distance between objects and substances, including sensory perception and magnetic attraction – was prudently recovered by Fracastoro here, but at the same time its actual application was critically rearranged and a diplomatic conciliation

---

<sup>41</sup> Fracastoro G., *De sympathia et antipathia rerum*, ch. 5 (my translation; original text with German translation in the collection by Stückelberger A. (ed.), *Antike Atomphysik. Texte zur antiken Atomlehre und zu ihrer Wiederaufnahme in der Neuzeit* (Munich: 1979) 248–251). 'Antiqui quidem, ut Democritus et Epicurus, quos e nostris Lucretius secutus est, effluxiones corporum, quas Athomos appellabant, principium eius attractionis ponebant; quae quidem effluxiones ne negandae quidem sunt, ut mox ostendemus, modus autem, quem ipsi tradebant, sat rudis et ineptus erat. Quem quoniam tum Alexander Aphrodisiensis, tum et Galenus satis aperte reprobant, a nobis praetermittetur. Verumtamen receptis Athomorum effluxionibus nos modum alium tradere posse videmur, quo attractio similium fiat: meminisse autem oportet eorum quae supra dicta sunt de consensu et motu partium in toto'.

attempted with Aristotle's qualitative doctrine.<sup>42</sup> Lucretius' contents, their basic reconnection of visible and invisible, enabled the careful integration of an atomic effusional view within the framework of chemical research and spiritual speculations.<sup>43</sup> In the same work, in fact, Fracastoro seeks to combine the traditional cognitive theory of Epicurus with his less materialistic concept of *species spiritualis*, a very thin emanation produced by common objects to cause sensory perception: therefore, the two terms of *species* and *simulacrum* are skilfully associated and the global result is a general spiritualisation of Lucretius' atomic world.<sup>44</sup> It must be said, in this regard, that the Epicurean-Lucretian doctrine concerning the soul, perception and related corpuscular phenomena plays an impressive role in modern reflection about matter and vital faculties. As mentioned earlier, in many cases Lucretius' use of *biological* evidence – sometimes returning to Peripatetic notions – operates as a basis to support modern scientific arguments, especially in contexts where Aristotle's assumptions are consciously revised. Thus, in a sort of mirror game, images and remarks deriving from the Aristotelian tradition, which had been adapted by Lucretius to explain Epicurus' physics, were revived in the eclectic debate of the sixteenth and seventeenth centuries. This is, for example, what we can observe in the reception of Lucretius' psychological theory. In his third

<sup>42</sup> See Stükelberger A., "Lucretius reviviscens: von der antiken zur neuzeitlichen Atomphysik", *Archiv für Kulturgeschichte* 54 (1972) 8–9. Goddard Ch., "Lucretius and Lucretian Science in the Works of Fracastoro", *Res Publica Litterarum* 16 (1993) 186–188, points out, instead, Fracastoro's inconsistent rejection of atomism in the following part of the same *De sympathia*; she reconnects the intention of recovering corpuscularianism shown in this passage to the subsequent discussion of 'seminaria' (seeds of disease) in *De contagione et contagiosis morbis*, whose two volumes formally compose a joint three-book work together with the *De sympathia*. On Fracastoro's relationship with Lucretius see also Johnson – Wilson, "Lucretius and the History of Science" 132–133; Haskell Y., "Religion and Enlightenment in the Neo-Latin Reception of Lucretius", in Gillespie S. – Hardie Ph. (eds.), *The Cambridge Companion to Lucretius* 190–192; Citti F., "Pierio recubans Lucretius in antro: Sulla fortuna umanistica di Lucrezio", in Beretta – Citti (eds.), *Lucrezio, la natura e la scienza* 132–135.

<sup>43</sup> On Lucretius' explanation of magnetism through the theory of atomic exhalations, supported as usual by many empirical arguments, see *Lucr.* 6.906–1089. It is no accident that the three examples Fracastoro 'uses to illustrate the principle of attraction all appear in *De rerum natura* to illustrate atomism: the attraction of the magnet, the attraction of the human body towards sense-perception, and sexual attraction. Lucretius explains the attraction in each case as an emanation of bodies from one object to another. In each case Fracastoro applies his rather ambiguous *species spiritualis*, each time emphasizing that the attraction could not be produced by atoms' (cf. Goddard, "Lucretius and Lucretian Science" 186): a very clear case of methodological eclecticism.

<sup>44</sup> Cf. Gemelli B., *Aspetti dell'atomismo classico nella filosofia di Francis Bacon e nel Seicento* (Florence: 1996) 64–66.

book, he had emphatically asserted the mortality of the soul, a proof being the divisibility of the *anima* through the body's limbs; the soul of both animals and men is present in every part of their organism, so if a limb of a living being were suddenly cut off it would keep its part of psychic substance for a certain time. In order to demonstrate this materialistic Epicurean assumption, Lucretius employs several gruesome arguments, such as the image of a snake whose pieces still move on the ground after it has been chopped up.<sup>45</sup> It is very likely that the origin of this zoological remark was Aristotelian, as in his treatise *On the Soul* Aristotle repeatedly mentions the survival of some animals in such circumstances as evidence for psychological conclusions.<sup>46</sup> In one of these passages he also uses such an argument framed as a polemical attack against Democritus and his atomistic view of the soul.<sup>47</sup> Lucretius, therefore, had shrewdly adapted and reversed a Peripatetic observation in order to support his Epicurean corpuscular theory.

Early modern naturalists, in this regard, were able to use the poem's account to refute Aristotle's opinions. Bernardino Telesio, for instance, opposes the Aristotelian theory of a soul located only in the heart, maintaining instead, in accordance with Lucretius, that the *spiritus* generated from the semen is diffused through the entire nervous system; he also claims that Aristotle's own remarks on the divisibility of animals lead to this natural conclusion, which is, as far as we can see, very close to that of Lucretius.<sup>48</sup> Similar arguments about the soul can also be found in many other modern thinkers, such as Agostino Doni, Sebastian Basso and Francis Bacon.<sup>49</sup> More generally, the Lucretian appeal to *biological* proofs in support of atomic views seems to have been a highly successful point in early modern debates. The bridge from corpuscular to organic, from visible to invisible, which Lucretius had created in his didactic work, is often rebuilt by sixteenth- and seventeenth-century physiologists in order to uphold their eclectic theories. Early modern supporters of atomism often mention the reference in Book 4 to small animals, whose 'third part' and internal organs cannot be seen, yet such parts nonetheless exist.<sup>50</sup> Giordano Bruno, for example, takes up this specific example in his *On the*

<sup>45</sup> Cf. Lucr. 3.634–669.

<sup>46</sup> Aristoteles, *De anima* 1.4, 409a7–10; 1.5, 411b.19–22; 2.2, 413b16–21.

<sup>47</sup> Arist. *De An.* 1.4, 409a.

<sup>48</sup> Telesio Bernardino, *De rerum natura iuxta propria principia* 5, 27.

<sup>49</sup> Cf. Gemelli, *Aspetti dell'atomismo classico* 106–108.

<sup>50</sup> Cf. Lucr. 4.110–122.

*Threefold Minimum and the Measure* (1591), openly recalling Lucretius,<sup>51</sup> and the same image is borrowed by Daniel Sennert and Sebastian Basso.<sup>52</sup> Bruno was deeply influenced by the poem's materialistic cosmology and by its concept of infinity, although he merged Epicurus' natural philosophy into his personal pantheistic, animistic convictions.<sup>53</sup> However, from the perspective we have adopted in this paper, it is no accident that a Lucretius-oriented philosopher like Bruno managed to build a model of 'vitalistic atomism', as it has been defined,<sup>54</sup> using so many images and ideas drawn from the *De rerum natura*. Lucretius was a malleable reservoir of physical principles based on biology and Bruno's passionate vein creatively reshaped them. He did it in such an intense way that he 'was explicitly questioned about his attraction to Lucretius at his trial for heresy'.<sup>55</sup> But in the same period more conventional, less provocative men of science were also attracted by Lucretius and used his physiological doctrines. Indeed, in a chapter of her study of Lucretius' and Epicurus' *Nachleben* in the Italian Renaissance, Susanna Gambino Longo pointed out that in this age even some interpreters and commentators of Aristotle refer to the *De rerum natura* in order to eclectically correct traditional Aristotelian views on physics and philosophy.<sup>56</sup> A particularly relevant

<sup>51</sup> Bruno Giordano, *De triplici minimo et mensura* 1,9,1–15 (original text with German translation in Stückelberger (ed.), *Antike Atomphysik* 250–252) 'subsistens minimum ex quo sunt composta, quod unum | in fine attingunt, quanta haec, quaecumque creantur, | ne credas modico seiungier intervallo | a minimo nostris obiecto sensibus, altam | accipito docti rationem mente Lucreti: | indicat ut tenui natura constet imago, | inquit enim rerum primordia corpora prima | tanto infra nostros sensus tantoque minora, | ut mire ad oculos minimae longo ordine partes | linquantur. Siquidem et animacula tanta videmus, | tertia pars quorum nulla virtute notari | possit. Quantum ergo cerebrum ventremque putandum? | Quantuli oculi? Quantum cor, nervus, viscera, quae sunt | partibus inde aliis certam quoque nacta figuram, | et pariter variis consistunt undique membris?'

<sup>52</sup> See Stückelberger, "Lucretius reviviscens" 10–18.

<sup>53</sup> On Bruno's relationship with Lucretius, who was one of his main models for style and ideology, see Haskell Y., "The Masculine Muse: Form and Content in the Latin Didactic Poetry of Palingenius and Bruno", in Atherton C. (ed.), *Form and Content in Didactic Poetry* (Bari: 1998) 117–144, esp. 127–138. Ead., "Religion and Enlightenment" 192–195, and Johnson – Wilson, "Lucretius and the history of science" 133–134. See also Salvatore M., "Giordano Bruno, Lucrezio e l'entusiasmo per la vita infinita", *Studi rinascimentali* 1 (2003) 113–120, and eadem, "Immagini lucreziane nel *De immenso* di Giordano Bruno", *Vichiana* 5 (2003) 123–134.

<sup>54</sup> See e.g. Johnson – Wilson, "Lucretius and the history of science" 133.

<sup>55</sup> Cf. Haskell, "Religion and Enlightenment" 195.

<sup>56</sup> See Gambino Longo S., *Savoir de la nature et poésie des choses. Lucrèce et Épicure à la Renaissance italienne* (Paris: 2004) 121–177. Prosperi V., *Di soavi licor gli orli del vaso. La fortuna di Lucrezio dall'Umanesimo alla Controriforma* (Turin: 2004) focuses more on literary matters than on scientific ones.

case here is the acceptance of quantitative approaches in the description of matter in Aristotelian, traditionally qualitative, systems. Lucretius succeeds in combining *primordia* and *principia*, the basic concept of atom with the biological idea of principle, which is comparable to Empedocles' and Aristotle's notion of 'element'. In this respect, modern Aristotelians are sometimes inclined to widen the Empedoclean-Peripatetic theory of the four elements, regarding the atoms of Democritus and Epicurus as just a possible enlargement of their 'elemental' conception. Aristotle had assumed that sublunary nature is composed of four elements, but to his Renaissance followers this number appears as a starting-point, subject to revision: and atomism occurs as a non-conflicting, integrable proposal. Francesco Vimercato, for example, who published a commentary on Aristotle's *Physics* in 1550, plainly quoted Lucretius and gave an informed account of ancient atomic theories: he saw corpuscularianism not as a danger for his doctrine, but as a chance to enrich it.<sup>57</sup> After all, Lucretius' poem was the main source for every attempt to recover classical atomism or simply to understand it. It is therefore very likely that its eclectic attitude towards the study of nature built an attractive basis for early modern versatility in corpuscular physiology. Imitated as a paradigm of poetry and science, condemned for his materialistic heresies or cleansed through conciliative undertakings, Lucretius was in any case a catalyzing ancestor: the voice of a world one could not ignore.

---

<sup>57</sup> Cf. Gambino Longo, *Savoir de la nature* 146–147.

*Selective bibliography*

- ARISTOTLE, *De anima*: ed. Jannone A. (1966), *De l'âme*, Les Belles Lettres, Paris.
- , *Historia animalium*: tr. Peck A.L., Loeb (Cambridge, Mass.-London: 1965).
- ASMIS E., *Epicurus' Scientific Method* (Ithaca-London: 1984).
- BARNES J., "Roman Aristotle", in Griffin M. – Barnes J. (eds.), *Philosophia togata II. Plato and Aristotle at Rome* (Oxford: 1999) 1–69.
- BERETTA M., "Gli scienziati e l'edizione del *De rerum natura*", in Beretta M. – Citti F. (eds.), *Lucrezio, la natura e la scienza* (Florence: 2008) 177–224.
- CITTI F., "*Pierio recubans Lucretius in antro*: Sulla fortuna umanistica di Lucrezio", in Beretta M. – Citti F. (eds.), *Lucrezio, la natura e la scienza* 97–139.
- DIANO C., *Scritti Epicurei* (Florence: 1974).
- DIERAUER U., *Tier und Mensch im Denken der Antike* (Amsterdam: 1977).
- DÜRING I., "Notes on the History of the Transmission of Aristotle's Writings", *Acta Universitatis Götoburgensis* 56, 3 (1950) 35–70.
- EINSTEIN A., "Geleitwort", in Diels H. (ed.), *T. Lucretius Carus. De rerum natura. Lateinisch und Deutsch* (Berlin: 1924), vol. 2, VIa–VIb.
- EPICURUS, *De rerum natura*: ed. Arrighetti G. (1973), *Opere*, Turin.
- ERLER M., "Epikur" in H. Flashar (ed.), *Grundriss der Geschichte der Philosophie (begr. v. F. Überweg), Die Philosophie der Antike 4, Die Hellenistische Philosophie 1* (Basel: 1994) 94–103.
- ERNOUT A. – ROBIN L., *Lucrèce, De rerum natura. Commentaire exégétique et critique*, 3 vols. (Paris: 1925–1928).
- FURLEY D.J., *Cosmic Problems. Essays on Greek and Roman Philosophy of Nature* (Cambridge: 1989).
- , "Lucretius and the Stoics", *Bulletin of the Institute of Classical Studies of the University of London* 13 (1966) 13–33.
- , "Variations on Themes from Empedocles in Lucretius' Proem", in ibidem, *Cosmic Problems. Essays on Greek and Roman Philosophy of Nature* (Cambridge: 1989) 172–182.
- GALEN, *De naturalibus facultatibus*: tr. Brock A.J. (1947), *On the Natural Faculties*, Loeb, London-Cambridge, Mass.
- GAMBINO LONGO S., *Savoir de la nature et poésie des choses. Lucrèce et Épicure à la Renaissance italienne* (Paris: 2004).
- GARANI M., *Empedocles Redivivus. Poetry and Analogy in Lucretius* (New York-Abingdon: 2007).
- GEMELLI B., *Aspetti dell'atomismo classico nella filosofia di Francis Bacon e nel Seicento* (Florence: 1996).
- GIGANTE M., *Kepos e Peripatos. Contributo alla storia dell'aristotelismo antico* (Naples: 1999).
- GODDARD CH., "Lucretius and Lucretian Science in the Works of Fracastoro", *Res Publica Litterarum* 16 (1993) 185–192.
- GOGUEY D., *Les animaux dans la mentalité romaine* (Brussels: 2003).
- GRIMAL P., "*Elementa, primordia, principia* dans le poème de Lucrèce", in *Mélanges de philosophie, de littérature et d'histoire ancienne offerts à Pierre Boyancé* (Rome: 1974) 357–366.
- HASKELL Y., "Religion and Enlightenment in the Neo-Latin Reception of Lucretius", in Gillespie S. – Hardie Ph. (eds.), *The Cambridge Companion to Lucretius* (Cambridge: 2007) 185–201.
- , "The Masculine Muse: Form and Content in the Latin Didactic Poetry of Palingenius and Bruno", in Atherton C. (ed.), *Form and Content in Didactic Poetry* (Bari: 1998) 117–144.
- JOHNSON M. – WILSON C., "Lucretius and the history of science", in Gillespie S. – Hardie Ph. (eds.), *The Cambridge Companion to Lucretius* (Cambridge: 2007) 131–148.

- JOHNSON M.R., *Aristotle on Teleology* (Oxford: 2005).
- LUCRETIUS, *De rerum natura*: tr./ed. Bailey C. (1963), Oxford.
- MANSFELD J., "Epicurus Peripateticus", in Alberti A. (ed.), *Realtà e ragione. Studi di filosofia antica* (Florence: 1994) 29–47.
- MEINEL CH., "Early Seventeenth-Century Atomism: Theory, Epistemology, and the Insufficiency of Experiment", *Isis* 79 (1988) 68–103.
- PICONE G. (ed.), *L'antichità dopo la modernità* (Palermo: 1999).
- PIGEAUD J., *La maladie de l'âme. Étude sur la relation de l'âme et du corps dans la tradition médico-philosophique antique* (Paris: 1981).
- , "La physiologie de Lucrèce", *Revue des Études Latines* 58 (1980) 176–200.
- PLINY THE ELDER, *Naturalis Historia*, X: ed. Saint Denis E. de (1961), *Histoire Naturelle, Livre X*, Les Belles Lettres, Paris.
- PROSPERI V., *Di soavi licor gli orli del vaso. La fortuna di Lucrezio dall'Umanesimo alla Controriforma* (Turin: 2004).
- ROMANO E., "Fine di un mondo antico: Costruzione, ascesa e declino di un'invenzione moderna", in Picone G. (ed.), *L'antichità dopo la modernità* (Palermo: 1999) 9–31.
- SALVATORE M., "Giordano Bruno, Lucrezio e l'entusiasmo per la vita infinita", *Studi rinascimentali* 1 (2003) 113–120.
- , "Immagini lucreziane nel *De immenso* di Giordano Bruno", *Vichiana* 5 (2003) 123–134.
- SCHIESARO A., *Simulacrum et imago. Gli argomenti analogici nel De rerum natura* (Pisa: 1990).
- SCHRIJVERS P.H., "Le regard sur l'invisible: Étude sur l'emploi de l'analogie dans l'oeuvre de Lucrèce", in Gigon O. (ed.), *Lucrèce. XXIV Entretiens Hardt sur l'Antiquité Classique* (Geneva: 1978) 77–121.
- , *Lucrèce et les sciences de la vie* (Leiden-Boston-Cologne: 1999).
- SEDDLEY D., *Lucretius and the Transformation of Greek Wisdom* (Cambridge: 1998).
- STÜCKELBERGER A. (ed.), *Antike Atomphysik. Texte zur antiken Atomlehre und zu ihrer Wiederaufnahme in der Neuzeit* (Munich: 1979).
- , "Lucretius reviviscens: von der antiken zur neuzeitlichen Atomphysik", *Archiv für Kulturgeschichte* 54 (1972) 1–25.
- TELESIO BERNARDINO, *De rerum natura iuxta propria principia*: ed. Franco L. de (Cosenza: 1974).
- TUTRONE F., "Libraries and Intellectual Debate in the Late Republic: The Case of the Aristotelian Corpus", forthcoming in König J. – Oikonomopoulou K. – Woolf G. (eds.), *Ancient Libraries* (CUP).
- , "Lucrezio e la biologia di Aristotele: riflessioni sulla presenza dell'opera aristotelica nel *De rerum natura* e nella cultura greco-latina del I secolo a. C.", *Bollettino della Fondazione Nazionale "Vito Fazio Allmayer"* 35, 1–2 (2006) 65–104.
- USENER H., *Epicurea* (Leipzig: 1887).
- VEGETTI M., *Il coltello e lo stilo* (Milan: 1996<sup>3</sup>).
- WOLFF E., "L'utilisation du texte de Lucrèce par Gassendi dans le *Philosophiae Epicuri Syntagma*", in Poignault R. (ed.), *Présence de Lucrèce. Actes du colloque tenu a Tours (3–5 décembre 1998)* (Tours: 1999) 327–336.



LOSING GROUND:  
THE DISAPPEARANCE OF ATTRACTION FROM THE KIDNEYS

Michael R. McVaugh

*Summary*

The classical understanding of the kidney's action, worked out by Galen, held that an attractive force in the organ drew the urine to it, admixed with blood, and that the urine was then filtered away from the thicker blood by the undifferentiated substance of the kidney. Galen rejected the possibility of a purely mechanical propulsion and separation of the urine, not least because mechanism could not explain why different organs filtered off different materials. This attraction/filtration model continued to be accepted by anatomists well into the seventeenth century, though their growing knowledge of renal structure led them to conclude (mistakenly) that the filtration occurred, not in the kidney as a whole, but at the newly discovered renal *papillae*. Subsequently, Harveian circulation eliminated the need for an attractive force in the kidney, and the growing vogue of mechanism then encouraged Malpighi to interpret the microscopic canals he saw within the organ as functioning like individual sieves rather than like filters, mechanically sorting particles of urine from other larger particles in the blood. While his new model was widely accepted, some contemporaries continued to feel that it could not completely explain the selectivity of the kidney.

The first research paper that ever had my name attached to it appeared forty-nine years ago, and it dealt with the physiology of the kidney,<sup>1</sup> which is why the history of kidney function appealed to me when this conference was announced. I know much more about urine and its production, therefore, than I do about blood, sweat, or tears, and for the purposes of this paper a brief preliminary summary of the anatomy and physiology of that organ may be useful for the general reader. If you cut open a human kidney, you will see a rather undifferentiated reddish mass, somewhat greyer at the outside (the cortex), redder inside (the medulla). [Fig. 1] You cannot discern that it is composed of about a million units called nephrons. Each unit consists of a tiny arterial capillary linked to a vein at a spot called the glomerulus, where the blood vessels are surrounded by the beginnings of

---

<sup>1</sup> Sullivan L.P. – McVaugh M.R., "Effect of Rapid and Transitory Changes in Blood and Urine pH on NH<sub>4</sub> Excretion", *American Journal of Physiology* 204 (1963) 1077–1085. On the context of this research, see Malvin R. L. – Sullivan L.P., "Stop-flow Technique: A Brief Episode in the History of Renal Physiology", *News in Physiological Sciences* 5 (1990) 180–182.

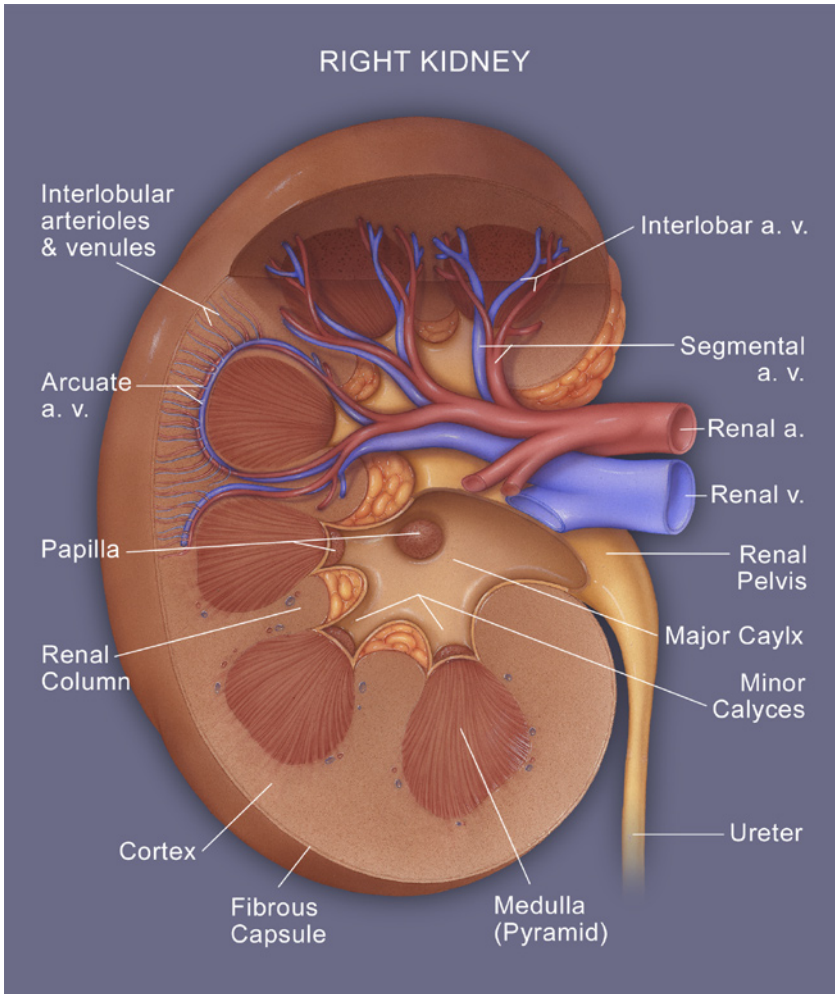


Fig. 1. Human kidney. Drawing Lauren Keswick.

a separate tubule. Blood flows into the kidney through the renal artery and arrives at these tiny capillaries in the glomeruli, which are up in the cortex. Part of the blood, the plasma, passes out of the glomerulus into the tubule, which winds back and forth through cortex and medulla and finally empties through sites called *papillae* into the renal pelvis, a reservoir that fills much of the central indentation in the kidney, a cavity called the renal sinus; the urine collected here passes out through the ureter into the bladder and then out of the body.

Historians of physiology always start the modern history of the kidney from Malpighi in 1666, writing in the wake of Harveian circulation, but our concerns here are less with discovery or innovation than with method and orientation and explanatory principles: did ancient writers look at the kidney differently from medieval and early modern authors? I want to suggest that changes were already occurring in the perception of that organ well before Malpighi wrote, indeed before Harvey's proclamation of the circulation in 1628. The changes can be seen quite clearly, in fact, in the writings of one of Harvey's most famous critics, Jean Riolan the Younger. But I will also suggest that there is a certain amount of continuity of approach as well.

### *The Galenic understanding*

About the general picture there has been little serious disagreement for 2300 years. Aristotle already distinguished three anatomical-physiological phases in *On the Parts of Animals* III.9: the movement of blood to the kidney; the production of urine in the kidney (as he says, 'by the filtration of blood through the solid substance of the organ'); and the movement of urine out of the body.<sup>2</sup> This is still a perfectly reasonable overall account of renal physiology and anatomy.<sup>3</sup>

---

<sup>2</sup> Aristoteles, *De partibus animalium* 3.9, 671b3–24 'In the centre of the kidney is a cavity of variable size [...]. The duct which runs to the kidney from the great vessel [the renal vein from the vena cava] does not terminate in the central cavity, but is expended on the substance of the organ [...]. A pair of stout ducts, void of blood, run, one from the cavity of each kidney, to the bladder [...] and other ducts, strong and continuous, lead into the kidneys from the aorta. The purpose of this arrangement is to allow the superfluous fluid to pass from the blood-vessel into the kidney, and the resulting renal excretion to collect, by the percolation of the fluid through the solid substance of the organ, in its centre [...]. From the central cavity the fluid is discharged into the bladder by the ducts that have been mentioned'.

<sup>3</sup> And see Marandola P. – Musitelli S. – Jallous H. – Speroni A. – Bastiani T. de, "The Aristotelian Kidney", *American Journal of Nephrology* 14 (1994) 302–306.

Five hundred years later, Galen thought much more systematically about the kidney, its structure and its function.<sup>4</sup> In fact, his analysis of its physiology is in some respects more thoughtful and more profound than anyone else's down to, and including, Malpighi. To be sure, his overall treatment of the organ in *On the Use of the Parts* is little different from Aristotle's, only more succinct: 'urine', he says, 'is secreted from the blood by the kidneys and passes thence through the ureters to the bladder'.<sup>5</sup> However, the different stages in the process are examined in a little more detail. Blood, says Galen, comes to the kidneys through both the renal artery and renal vein, admixed with yellow bile, and it does so by attraction. Within the kidney, blood saturates the organ and becomes its nutriment, while the watery portion of the blood and the bile 'escape' from the kidney through its tubes to the bladder; the blood itself is prevented from escaping because of the density of the kidney, which allows only the thinner part to pass through, 'without elaborating, concocting, and transforming it'.<sup>6</sup> The principal non-Aristotelian element in this account is the idea that an *attractive power* is what originally brings the blood to the kidneys.

Galen had already developed the idea of attraction as a physiological agent, distinct from mechanical impulse, in *On the Natural Faculties*, and indeed had exemplified it there by appealing to the activity of the kidneys; his discussion there provides us with a particularly detailed account of what happens in the first of Aristotle's three phases. He is quite clear-headed about the alternatives: either a mechanical propulsion brings the blood to the kidney, there to be purified of its watery portion, or the kidneys themselves attract what is to be discarded. But if a mechanical force brought the blood there, *all* the blood would have to be filtered through the kidneys to be purified, and that cannot happen since the kidneys lie on either side of the vena cava and aorta and most of the blood would be forced straight on down those vessels by gravity; under the mechanical hypothesis, therefore, only a part of the blood can be purified.<sup>7</sup> Moreover, if that were the case, and the watery portion were to be strained away, the thick blood left behind would prevent the arrival of further impure blood, unless it could somehow run back to the vena cava against the

<sup>4</sup> A useful account is given by Shank M.H., "From Galen's Ureters to Harvey's Veins", *Journal of the History of Biology* 18 (1985) 331–355, esp. 332–336.

<sup>5</sup> Galenus, *De usu partium* 5.5 (1.256 May; 3.363 K.).

<sup>6</sup> Galen, *De usu part.* 5.7 (1.261 May; 3.373 K.).

<sup>7</sup> Galenus, *De facultatibus naturalibus* 1.15, 1.16 (93, 101 Brock; 2.59; 2.65 K.).

pressure of the incoming blood.<sup>8</sup> It can thus only be a selective attractive principle that brings all the watery material to the kidney to be evacuated. Presumably (though the point is not made here, as it is in *On the Use of the Parts*) at the same time some pure blood is drawn to the kidney for its nourishment. In either case, there is no longer any need to worry about a mechanically opposing flow impeding kidney function. We may note that Galen is attacking mechanism as an explanation of this first phase of kidney function not *a priori* – he certainly believes in the power of mechanistic reasoning – but because in this phase a mechanistic explanation of kidney function can be shown to be internally inconsistent with what one observes.

And what happens in the second phase? Here Galen may seem somewhat confusing and inconsistent. We have seen that, in his view, it is attraction that ensures that all the serous part of the blood will be brought to the kidney. To explain what happens after it has arrived there, however, he seems to prefer a mechanistic explanation. In *On the Use of the Parts*, he says that to the extent that an attracting organ ends in tiny openings, the fluid that is attracted to it will be pure: therefore, because the outlets of the kidneys are narrow, they allow only serum and a little bile to pass, while the thicker part of the blood is retained by the dense substance of the kidney.<sup>9</sup> In *On the Natural Faculties*, indeed, he actually says that blood passes through the kidneys, in Brock's translation, 'as if through a sieve'.<sup>10</sup> He does not say, as he perfectly well could, that attraction brings the serum but not the blood to the kidney's outlets. It is apparently physical size, not an attractive faculty, that he believes is responsible for the selective excretion.

The device to which Galen here seems prepared to compare the kidney, at least tentatively, is a strainer, *êthmos*. The term was applied to a basket woven from flexible plant material, like reeds, used to filter off the juice from pressed grapes or olives, and to a pierced metal tray designed to filter wine as it was served at meals. In either case the term denoted an instrument for separating liquid from solid. To translate *êthmos* as 'sieve', as in the passage above, is misleading, since that term would better represent

---

<sup>8</sup> Galen, *De fac. nat.* 1.16 (101–103 Brock; 2.65–66 K.). The account by R.E. Siegel (*Galen's System of Physiology and Medicine* [Basel-New York: 1968] 128) is misleading; the back-flow of thick blood is not what Galen thinks obtains and needs to be explained, but a counterfactual that he thinks cannot obtain.

<sup>9</sup> Galen, *De usu part.* 5.6 (1.260 May; 3.371–373 K.).

<sup>10</sup> Galen, *De fac. nat.* 1.16 (101 Brock; 2.65 K.).

*kostikon*, the woven tray used to separate differently-sized solid materials, for example in sifting and purifying flour.<sup>11</sup> Like a strainer, Galen seems to be saying, the kidney holds back the thick sludge of the blood and allows the far thinner serum to pass through into the ureters.

And yet, Galen continues, if one thinks about it more carefully, there is one inescapable reason why this apparently plausible mechanical filtration *cannot* explain the production of urine and the body's other distinct excretions. Consider the bile, which is drawn off from the blood by the bile duct just as serum is drawn off by the kidney. If it were merely the physical aperture of the duct that allowed bile to pass while holding back the blood, then the thinnest part of the blood, the serum, would run through the bile duct even faster:

if the yellow bile adjusts itself to the narrower vessels and stomata, and the blood to the wider ones, for no other reason than that blood is thicker and bile thinner, and the stomata of the veins are wider and those of the bile-ducts narrower, then it is clear that this watery and serous superfluity [urine], too, will run out into the bile-ducts quicker than does the bile, exactly in proportion as it is thinner than the bile [...]. Thus every hypothesis of channels (*porôn*) as an explanation of natural functioning is perfect nonsense.<sup>12</sup>

Here I think Galen *is* conceiving of the kidney (and bile duct) as a sieve, in order to visualise its comparative action not on fluids vs. solids, but on solid particles that are different in kind but of comparable size. If excretory organs like the bile ducts or the kidney were supposed to act passively and mechanically, like a sieve, on the differently-figured constituents of the blood, we could not explain their differential action; we could not explain why the smallest or thinnest material in the blood – the watery serum that constitutes the urine – should not be excreted by every such organ rather than by the kidney alone, as is in fact the case. The apparent inconsistency in Galen's discussion, his willingness to adopt a mechanistic explanation for the separation of urine from the remainder of the blood contrasted with his insistence that mechanism is logically inconsistent with his observations of the selectivity of bodily function, is, I suggest, because he is considering the kidney sometimes as strainer and sometimes as sieve. He has no difficulty imagining the body's organs as physi-

<sup>11</sup> On these terms, see Daremberg C. – Saglio E., *Dictionnaire des antiquités grecques et romaines* (Paris: 1875–1919) 1,1331–1333 (*colum*) and 1,1568 (*cribrum*).

<sup>12</sup> Galen, *De fac. nat.* 2.2 (123–125 Brock; 2.78–79 K.), 2.3 (127 Brock; 2.80 K.) and see Siegel, *Galen's System* 129.

cal strainers, separating thin sera from gross blood, but when he has to visualise them as sieves, each separating a particular kind of solid particle and rejecting all others, he has to recognise that at this point mechanical explanations are impossible. Mechanism can often provide general explanatory principles: but specific action and discrimination among possible outcomes require a different kind of agent. *Is the kidney a physical strainer, a filter?* I am not at all sure what Galen would say if you asked him that directly: yes and no, perhaps.

In phase three of kidney function, as it happens, Galen has no difficulty in accepting a purely mechanical flow of urine through the ureters into the bladder and out through the urethra; it seems he feels no need to imagine, say, an attractive faculty in the bladder that would draw the urine to it. *On the Natural Faculties* contains a famous description of an experimental demonstration of this flow: if in a living animal the ureters are tied, they will be seen to become full and distended above the ligature; and 'on removing the ligature from them, one then plainly sees the bladder becoming filled with urine'. In turn, if the urethra is ligatured and the full bladder compressed, one finds that it is impossible to force urine back up through the ureters.<sup>13</sup> Here I only summarise Galen's account, but it is clear that he imagines this to be a closed system where gravity and hydrostatic pressure are the only agents that we need to posit to account for this last phase of kidney function. He assumes, I think, that where we have fluids in a closed system we can have confidence in mechanical principles to explain what is happening.

Galen left significant remarks about renal physiology in one other work, *De locis affectis* (known to the Middle Ages as *De interioribus*). Here he says again that the kidneys attract the watery substance, implying that it is separated from the blood in the veins by the attractive power (and thus that the two do not move together); the context of these remarks was a discussion of how a great quantity of ingested fluid can move immediately to the kidney, without dragging along with it a correspondingly large amount of blood. And he is also explicit here that the bladder does not attract the urine; instead, the kidneys send it to the bladder through the ureters.<sup>14</sup>

As regards the kidney and urinary excretion, therefore, Galen appears to think mechanically up to the point where he has to conclude that

<sup>13</sup> Galen, *De fac. nat.* 1.13 (59 Brock; 2.36–37 K.); 1.13 (61 Brock; 2.36–37 K.).

<sup>14</sup> Galenus, *De locis affectis* 6.3 (Siegel 175–176; 8.396, 398 K.).



mechanical explanation will no longer work, at which point he turns to attraction as an explanatory principle. And I wonder whether this may not be in keeping with a remark that he makes early on in *On the Natural Faculties*, when he explains what he means by a 'faculty'. A faculty, he says – like the attractive power of the kidney, for example – is an explanatory principle for a specific natural function, yet it is not an absolute, it itself can be explained; but 'so long as we are ignorant of the true essence of the cause which is operating, we call it a faculty'.<sup>15</sup> Attraction is a real power, of course, and a basic explanatory principle in nature, but it acts on materials which can also move mechanically. In a sense, by identifying the aspects of kidney function that are mechanical, and setting them to the side, we can narrow down the locus of that attraction. Once we set aside venous transport to the kidney and uretal flow from the kidney, we are left with the substance of the kidney itself as the implied source of an attractive faculty.

*The "Mondino Kidney": Membranes and strainers*

Latin translations of these three Galenic works were available to the European academic world of the early fourteenth century, as it began to construct its own understanding of human physiology. *De iuvamentis membrorum*, based on an Arabic adaptation of *On the Use of the Parts*, gives the kidneys an active role in 'distinguishing' the urine by attracting it away from the blood.<sup>16</sup> The Latin version of *On the Natural Faculties* (entitled *De virtutibus naturalibus*) accurately rendered Galen's rejection of a filtration-like separation.<sup>17</sup> And the basic Galenic principle that inherent attractive forces exist in the body had been reinforced by developments in Arabic medicine that were passed on to Europe: the treatise of Avicenna on cardiac medicines, in particular, used the example of magnets to illustrate how bodies could generate properties derived from their own unique substance that had to be determined empirically and could not be

<sup>15</sup> Galen, *De fac. nat.* 1.4 (17 Brock; 2.9 K.).

<sup>16</sup> Galenus, *De iuvamentis membrorum* 6.3, vol. 1 fol. [23] vb 'Superfluum residuum subtile quod remansit in sanguine scilicet urina distinguitur a sanguine per duas renes et sunt positi prope epar [...] ad attrahendum aquositatem a sanguine fortius [...]. Ista ergo est dispositio urine in distinctione eius a sanguine per renes'.

<sup>17</sup> Galenus, *De virtutibus naturalibus* 1.15 vol. 1 fol. [38] rb 'Non igitur ut ythimi [= ὑθμοί] id est colatoria transcolant, mittente quidem illa, ipsi vero nullam neque contingentem inferentes virtutem, sed trahunt et ducunt'.

predicted.<sup>18</sup> It was easy for Latin authors to identify the attractive faculty possessed by the kidney with an Avicennan *proprietas*, a property derived from the organ's substantial nature.

There were some European writings on anatomy and an associated physiology in the twelfth and early thirteenth centuries, but the real revival of European attention to the subject began in the later thirteenth century: first with the emergence of a would-be learned surgical tradition, one that drew first on Greek and Arabic sources for its accounts of the human body, and then on the beginnings of anatomical demonstrations by medical masters at Bologna and elsewhere, who juxtaposed their observations with the recovered Galenic texts. In one such demonstration, performed in 1316, Mondino dei Liuzzi took a new step towards a study of the kidney. As far as the evidence goes, Galen never tried to describe the organ's structure in any detail, in effect treating it simply as a link between blood vessels and ureters, but Mondino tried to narrow down just where that link was, where the change from blood to urine occurred. After referring to the two Galenic works discussed above to prove that the kidneys attracted both *aquositas* and *sanguis*, he went on as follows:

Let us cut the kidney lengthwise on the convex side down to its sinus; then you will immediately see a certain membrane or thin covering, which is the wall of the *vena emulgens* [renal vein], thinned so as to make a kind of strainer (*colatorii*), and by its porosities urine may pass but not blood. Thus the urine is filtered (*collatur*) and drips downward from the opening to the ureters that are united with it, which descends further to the bladder [...]. Blood remains in the kidney and is attracted into its substance, and thus it is nourished.<sup>19</sup>

<sup>18</sup> McVaugh M., 'The 'Experience-Based Medicine' of the Thirteenth Century', *Early Science and Medicine* 14 (2009) 115–117.

<sup>19</sup> Mondino dei Liuzzi, *Anatomia* (Pavia, de Carcano: 1478), repr. in Wickersheimer E., *Anatomies de Mondino dei Liuzzi et de Guido de Vigevano* (Geneva: 1977) 23a 'Si urina ad renes pervenit cum sanguine mixta, et ad vesicam depurata et separata a sanguine, oportet quod in renibus depuretur et colletur. Collatur autem quia ad concavitatem pervenit renem, quam videre [ed.: videre] debes. Scindemus renem in parte gibosa eius non concava et per longum protrahere usque ad concavitatem videas; tunc statim apparet tibi quidam panniculus sive pannus rarus, et ista est vena emulgens rara, facta ad modum collatorii, et per porositates has potest urina transire, sanguis autem non, et ideo collatur urina et distilletur inferius ad orificium cui continuatur porrus uritides qui descendit inferius usque ad visicam [...]. Sanguis remanet in rene et attrahitur ad substantiam eius et nutrit renem'. My English translation slightly modifies that provided in Ketham Joannes, *The Fasciculo di medicina, Venice, 1493*, ed. Singer C. (Florence: 1925) 2,23.

Mondino here did what no one before him in the Middle Ages had done, perhaps no one in Antiquity, and tried to use his observation of kidney structure to help localise where the emission of urine took place, conceived of still as passing through a filter (*colatorium*), not a sieve (*cribrum*). Galen had treated the kidney as an undifferentiated solid mass from which the serum somehow emerged; Mondino thought he could see a structure within the renal sinus whose pores gave passage to the urine but not the blood.

Yet it is important to be very careful here, and to recognise that Mondino's kidney (and perforce Galen's) is not our own. Our modern kidney is typically depicted as a dull red bean-like entity with a hollow space at its core (the renal sinus) containing three sharply distinguished vessels: a vein, an artery, and the renal pelvis that turns into the ureter. But these detailed structures are not simple 'givens'; they had to be learned by anatomists in tandem with a growing knowledge of their function. Mondino, cutting through the kidney, did not see three different vessels filling an open space in a semicircular kidney; he saw, I suspect, three vessels penetrating into what amounted to a hollow or cavity (a *sinus*, in Latin) in a closed kidney, sealed off from the rest of the body. The confusion of tissues packed together in that space would not have been easy for him to disentangle, and he evidently concluded that they amounted to a kind of strainer wall that divided the renal vessels from the ureters so that there, in that cavity, the urine was filtered out from the blood – blood which was then drawn into the rest of the kidney to nourish it. *Our* kidney is composed simply of medulla and cortex; Mondino's kidney was not divided into those two parts, and it was not sharply demarcated from the tissues around it and within it.

Mondino's *Anatomia* remained a foundational text for the teaching of anatomy well after 1500, and that certainly helped ensure that Renaissance anatomists continued to see the 'Mondino kidney', but in any case it was difficult for them, too, to master the content and structure of the kidney and its sinus. Andreas Vesalius, for example, in his *Fabrica* of 1543, seems almost perverse in the carelessness of his description of that organ. The standard narrative of the discovery of the circulation tends to begin with Vesalius and with his supposed scepticism about the Galenic pores passing through the intra-ventricular septum of the heart. Some historians of nephrology would like to present him as a watershed figure in their subject too, but in fact Vesalius's account of the kidney and of its function is surprisingly superficial – as well as ignorant of important developments in his own day, as we will see. His self-promoting dismissal of 'all [modern]

authorities' as regards renal anatomy has been blindly repeated by historians, who take him at his word when he attributes to his contemporaries the universal conviction that

there are two sinuses lying lengthwise along the kidneys, one on top and one underneath, and that there is a transverse membrane dividing these [...], that the vein and artery of the kidney end in the upper one, into which they pour serous blood, and that the membrane dividing the two sinuses is pierced with such tiny and narrow holes that it allows the thin and aqueous residue to pass through along with the bile, whereas the blood is too thick to penetrate it.<sup>20</sup>

Vesalius even went to the trouble of incorporating a plate for this supposed renal model into the *Fabrica* [Fig. 2], illustrating a hollow kidney divided into two halves by a porous plate that he labelled mockingly the *beatum et nugacissimum colatorium, seu membrana cribri modo pervia*<sup>21</sup> – the mockery lies not only in the teasing adjectives, but in implying that it was ridiculous to suppose that a filter (of fluids) could be imagined as nothing more than a membrane pierced with holes.

Modern historians have taken Vesalius at his word, believing that this was the common view of Renaissance anatomists, but if we actually read the writings of his contemporaries we find that their accounts are far less precise than this, not much changed in fact from Mondino's. Vesalius's parody was simply a self-promoting simplification of the Mondino kidney. One author who might be said to describe a two-sinus kidney is Guinter d'Andernach, Vesalius's teacher at Paris, but Guinter was almost certainly trying to describe the structure of the cavity surrounded by the organ, not that of the organ itself. Guinter's language is not entirely clear, but he seems to have posited a demonstration: one can isolate the renal vein and divide it down to a space, a sinus, where it broadens out and subdivides into many branches; here one sees the membrane through which

---

<sup>20</sup> Vesalius Andreas, *De humani corporis fabrica* V.10 (Basel, Oporinus: 1543; repr. Brussels: 1964) 515 'Adeo sane ut nunc omnibus recepta probataque sit opinio, duos in renibus esse sinus, secundum visceris longitudinem sitos, elatiorem scilicet unum, demissiorem alterum, qui transversa quadam membrana interdividuntur, superior dico ab inferiori. In superiorem renis venam arteriamque finire, easque serosum sanguinem in illum infundere, deinde membranam sinus intercipientem, tam arctis angustisque foraminulis perviam esse, ut et aqueum illud ac tenue recrementum et bilem quoque transmittat, sanguine interim propter sui crassitatem non penetrante'. The translation is found in idem, *On the Fabric of the Human Body. Book V, The Organs of Nutrition and Generation* (Novato, CA: 2007) 132.

<sup>21</sup> Vesalius, *Fabrica* 515. Hayman J.M. Jr., "Malpighi's 'Concerning the Structure of the Kidneys': A Translation and Introduction", *Annals of Medical History* 7 (1925) 242, mistakenly interprets this account of kidney structure as one that Vesalius himself accepted.

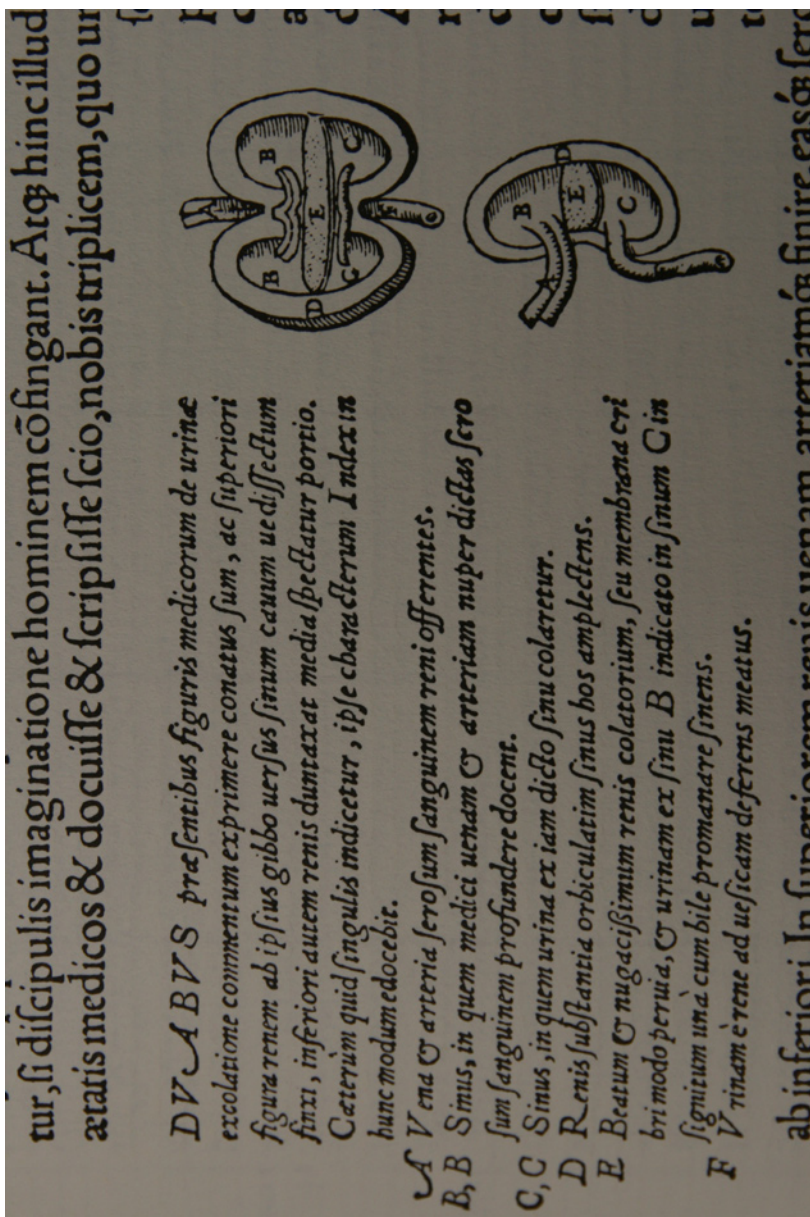


Fig. 2. Hollow kidney divided into two halves; Andreas Vesalius, *De humani corporis fabrica* (Basel, Oporinus: 1543).



the urine seeps (*distillat*) into another lesser sinus (presumably the renal pelvis) that is drained by the ureters. The renal vein and the renal pelvis are of course distinct anatomically, but he may have thought that their two contiguous coats were one, very much as Mondino apparently did.<sup>22</sup> Thus while Guinter did indeed speak of two sinuses separated by a membrane, he did not locate them within a hollow kidney, and he certainly did not describe the membrane as pierced with holes like a sieve.

In fact, Vesalius's own description is not all that different from his teacher's, for he too described two sinuses in the kidney: one is 'a hollow and membranous body' formed by the confluence of the renal vein and renal artery, which is always full of blood and which then branches out into all parts of the kidney (very much like Guinter's first sinus), and lying within these branches there is a second renal sinus filled with fat out of which the urinary channel arises. And how did he relate form to function? He represented contemporary authorities as believing that 'the urinary channel grows out from the lower sinus and receives the now filtered urine. But in fact the Creator of the world in his wisdom did not assign so important a task to one little membrane perforated like a sieve [*uni membranulae cribri modo perforatae*; again we recognise the Vesalian mockery]'; it is instead 'the substance of the kidneys, by virtue of a faculty innate within itself and in conjunction with its own finely adjusted warmth, [that] strains out (*excolat*) the serous residue [...] and then pours

---

<sup>22</sup> Guinter Johannes, *Institutionum anatomicarum secundum Galeni sententiam libri quatuor* (Paris, Colin: 1536), fols. 30 recto-31 recto 'Carne constant densa, solidaque, facultatibus praedita, quibus aquosam humiditatem primum ad se alliceant, deinde alienum a familiari separent: postea id per meatum, ab urina dictum *ouretera*, ad vesicam expellent: idque diversis vasorum oris, ut aliae attractioni, aliae expulsionis serviant. Insuper bilis etiam flavae multum attrahit, et fere id eius universum, quod utique arterias eius et venas habere contigerit. Item non parum sanguinis, quod scilicet eius est humidius, et subtilius. Verum biliosum excrementum, quodcunque non fuerit admodum crassum, cum urinis egreditur, unde urinae flavescunt. Ne autem sanguis, ita per meatum urinarum excidat, quod aliquando in renem profluvio contingit, densa firmaque facta est ipsorum caro, in quam ille regurgitat, exundatque, et hinc iam paulatim vaporis modo in totam ipsam disseminatur, apponitur, adnascitur, verum denique nutrimentum efficitur. Sinus in utroque existit, corpore quodam membraneo circumdatus, quem ut videas, alterum e duobus renibus (dextrum autem potius sinistri vasis seminarii gratia) adipe membranosa [1538 membrana adiposa] ipsi obhaerescente denutato: ac ubi venam, qua [1538 et arteriam quae] sanguinem defert [1538 deferunt], funiculo interceperis, per gibbam eius partem in longum dividito, usque cum scalpro ad sinum eius perveneris: in quo vasa plures in ramos diffundi cernes, ac membranam, qua urina distillat in alium sinum minorem, quem excipit meatus oblongus, quem *ouretera* nominavimus'. Essentially the same text is given in the edition of Venice, Bernardinus: 1538, fols. 28 recto-verso.

it into the sinus that receives the urinary channel'.<sup>23</sup> His argument with his contemporaries, I believe, is implicitly over what causes the separation to take place, and this is what has led him into parodying their views on anatomy, because function has to accord with form. The Vesalian model is designed to undercut the idea that the separation of urine from blood might be merely a mechanical sieving of differently-sized particles by the pores. If there is no sieve-like entity to be seen, it must then be the substance of the kidneys, possessed of a separative faculty or property, that brings about a filtration of urine from blood, which then merely passes out through pores into the ureters.<sup>24</sup>

*The Renaissance kidney: From membranes to papillae*

I have suggested that the Mondino kidney was in part a natural product of the kind of gross longitudinal dissection described by Mondino and illustrated in Vesalius's parodic woodcut, which effectively treated the organ as a whole. I would also suggest that new sixteenth-century techniques of analysis which focused on understanding the kidney as a collection of parts were decisive in bringing about a different picture of the organ, and they too can in a sense be traced back to Mondino's account. In 1502 Antonio Zerbi produced a commentary on Mondino in which he declared that the urine is separated from the blood at the fine openings at the ends of the emulgent veins where they enter the renal substance.<sup>25</sup> When in 1521 Berengario da Carpi in turn published a commentary on Mondino's work, he addressed the same question – where does blood change to urine? – but he used a mixture of experimental and anatomical investigation to pursue it, as we might say, physiologically. Does the change really take

<sup>23</sup> Vesalius, *On the Fabric* 132; idem, *Fabrica* 516. Cf. *Fabrica* 517 'manifestum [...] renum substantiam [...] aqueum illum humorem colare'.

<sup>24</sup> The same image – a filter (*colatorium*) as a solid rather than perforate body – is attributed by Vesalius to other anatomists a little later on: 'quibusdam accurate sectionem agredientibus ita imposuit, ut hunc adipem urinarii meatus operculum quoddam esse, et urinae in renibus excretioni seu colationi praefici, et quoddam velut colatorium esse, scriptum reliquerunt' (*Fabrica* 516). Vesalius describes this idea as a delusion, but because its adherents have misunderstood the anatomy of the kidney, not because urine could not filter through the renal fat.

<sup>25</sup> He says of the resultant structure that it is 'in similitudinem colatorii, sive cribri ut communiter dicitur' [my italics]; De Santo N.G. – Bisaccia C. – De Santo R.M. – Touwaide A., 'The Pre-Vesalian Kidney: Gabriele Zerbi, 1445–1505', *American Journal of Nephrology* 22 (2002) 164–171, esp. 169–171.



place at the terminus of the renal veins, as Zerbi said? Berengario used a syringe to push warm water through the vein into the kidney; the kidney swelled, but nothing emerged from the ureter. Then, dissecting the ureter, he discovered that it opened into a large space (*lacuna*) up against the wall of the kidney itself, which was marked with fleshy swellings like nipples (*papillae*), and that urine seemed to be coming out there (*circa illas*), perhaps 'sweated out like milk from the breast'; we still know these structures by the name Berengario gave them.<sup>26</sup> Then, tracing the course of the renal vein in the sinus as well as he could, he saw that it continued to branch out in the direction of these swellings. First by forcing water into the vein, then by tracing the ureter back into a kidney, Berengario had shown how those two exterior vessels were continuous with specific structures inside an open centre in the organ: he described a somewhat different organ from the one Mondino saw, one that was now sharply marked off from the vessels that enter its sinus.

Seeing the kidney afresh necessarily called back into question how the separation of urine from blood took place. The urine is no longer produced at a juncture between vein and ureter, it originates instead within the dense, solid body of this new kidney: is it attracted away from the blood by the kidney's substantial nature, or physically drawn off by some kind of filter within the organ? Berengario expressly set down his hope that, with more observations, 'I may decide with more assurance whether such a filter exists in nature or not,'<sup>27</sup> and eventually, in a work published after his death, in 1535, he concluded that Galen had been right. 'There is no net, as some think, no tissue in the kidney that acts like a strainer (*colatorium panniculare*); the kidneys are simply organs which attract [the blood] through some of their openings and give off a subtle watery superfluity through others', he wrote, although he seems to have endorsed the further Galenic suggestion that the density of the kidney is a complementary factor that helps retain the blood and allows the subtle urine to pass

<sup>26</sup> Berengario da Carpi, *Commentaria Mundini* (Bologna, H. de Benedictis: 1521) fols. 178 verso-179 recto. I have consulted the text as reproduced in De Santo N.G. – De Santo L.S. – De Santo R.M. – Di Leo V.A. – Papalia T. – Cirillo M. – Touwaide A., "Berengario da Carpi", *American Journal of Nephrology* 19 (1999) 211.

<sup>27</sup> De Santo et alii, "Berengario da Carpi" 210 'Certificabor de maiori resolutione talis colatorii, an sit in natura vel ne'. The authors write that 'he [Berengario] has a negative opinion about the existence of a sieve (*colatorium*)', but the language of this passage does not bear this out. Nor is it true, as they say, that 'he demonstrates that urine is not formed through a milk-like exudation process'; instead, he was again non-committal. He had indeed wondered at first whether it might be true, but after studying the question said simply 'hoc non potui videre' (ibidem 211).

through.<sup>28</sup> He certainly made no reference to the 'sieve-like' membrane that Vesalius said 'all modern anatomists' believed in.

Indeed, Vesalius seems unaccountably to have been oblivious to other aspects of Berengario's work on renal anatomy; neither his parody in the *Fabrica* nor his own model of the organ makes any reference to the *papillae* that had been described more than twenty years before. But Berengario's discovery was not lost on other great anatomists at mid-century: both Falloppio (1561) and Eustachio (1563), for example, acknowledged the existence of Berengario's renal *papillae* and incorporated them into their conceptions of kidney function. For these men, as for Berengario, blood was attracted to the kidney through the renal vein and artery, and serum was expelled through the *papillae* – but what happened in the kidney, and how, remained mysterious. Eustachio, indeed, cut sections across the kidney, through the breast-like swellings, and thought he saw hair-thin grooves running across the organ, across which he supposed the urine was somehow strained; yet he too, like Berengario before him, tried to force liquid through the kidney from both the renal vein and the ureter, and again found it impossible to demonstrate any connection between the two.<sup>29</sup> So the kidney remained a kind of 'black box' at the beginning of the seventeenth century, with blood drawn into it through the veins, urine dripping out from its *papillae*, and its dense undifferentiated substance, the ground of its attractive powers, in between.

This is indeed the picture presented by the two great anatomical surveys of the day, Caspar Bauhin's *Institutiones anatomicae* (1604) and André DuLauren's *Historia anatomica* (1600). Bauhin's brief account mentioned both the kidney's density and the narrow openings of the *papillae* as factors explaining why the organ retained blood but allowed urine and yellow

---

<sup>28</sup> Berengario da Carpi, *Anatomia Carpi* (Venice, Bern. de Vitalibus: 1535) fol. 16 verso "Trahit spiritum et nutrimentum et superfluitates aquosas totius corporis colere mixtas; haec omnia mixta per totam Renis substantiam licet solidam transeunt, quia sunt subtilia. Sanguis enim non transiret solus ad minimas partes Renum, quia solidi sunt, nisi esset aquositati et colere mixtus [...]. Hic sanguis multe aquositati mixtus solus retinetur a Renibus pro suo nutrimento, et aqua cum colera simul a sanguine desecata transit ad certam vacuitatem notabilem existentem in centro Renis, tanquam ad lacunam [...]. Et in Rene non est Rete nec aliud colatorium panniculare ut putant aliqui, sed Renes facti sunt organa concava, orificiis aliis quidem attrahentia, aliis autem emittentia subtilem aquosam superfluitatem".

<sup>29</sup> Much of Eustachio's text is reproduced in Grondona F., "Strutturistica renale da Galeno al Highmore", *Physis* 5 (1963) 185–189; in these passages Eustachio never speaks of the kidney as either a *colatorium* or a *cribrum*, but he does repeatedly use the verb *percolari* to describe the passage of urine through the organ.

bile too to filter out,<sup>30</sup> and suggested in passing that the organ's attractive power or 'proprietas' might arise from its heat.<sup>31</sup> DuLaurens had a little more to say about the organ, taking pride in having looked more closely at its internal structure than even Falloppio and Eustachio, but by that he really meant the structures visible in the sinus. The kidney proper he simply describes as 'of a unitary substance', assigning it an undoubted power to draw the serum to it through the renal vein and artery (though other forces, like heat, might also be at work to convey it there): he seems to be echoing *On the Natural Faculties* in his rhetorical question, 'Why should the serum pass into the kidneys rather than some other member if there were not a special attractive power located there?'<sup>32</sup> Once, he declares, he agreed with the common view (and here we hear the echo of Vesalius) that a membrane divided two spaces in the sinus, one supplied with blood which seeps through to become urine in the other, but he now knows better: his observations have shown him the renal vein and artery branching more and more finely as they move deeper into the central hollow of the organ, and he believes that they must eventually connect directly to the *carunculae* ('papillae'), and in those hair-like connections the serum filters through (*transcolatur*) and drips out into the pelvis and ureters as urine, while the blood left behind proceeds on to nourish the kidney.<sup>33</sup> DuLaurens thus seems to have thought that the kidney attracted the mixture of blood and serum by virtue of its substantial nature, retained the blood for its own purposes, and left the urine to drain off through tiny apertures.

It was on Bauhin's text that William Harvey based himself when he began to prepare his anatomical Lumleian lectures, about 1616, and he

---

<sup>30</sup> Bauhin Caspar, *Institutiones anatomicae corporis virilis et muliebris historiam exhibentes* (s. l. [Lyons], Le Preux: 1604) 53–54 'Ventres duos habent: Exteriorem, in quem Vasa feruntur: et Ureteres egrediuntur: hi in ipsis instar pedis anserini divisi, Carunculas amplexantur, et hoc Colatorium dicitur: Interiorem vero, ne quid sanguis cum Urina elabatur, quem membrana ad tutelam, ne cavitas occludatur, succingit: in hoc Carunculae subal-bae, papillis similes, angustissime perforatae, ne sanguis, qui a Renibus pro nutritione et quidem eorum quadam proprietate allectus, una cum sero effluat, hic enim Carni renum aspergitur, inde paulatim vaporis modo in totum dispergitur, adhaerescit, atque demum alimentum fit renibus. Renum enim usus, serosam superfluitatem a sanguinis tam venosi quam arteriosi massa repurgatum, recipere, quamvis et bilis flavae multum attrahant, que (at crassior pars), cum urinis permeat, unde et urinae flavescunt'.

<sup>31</sup> Bauhin, *Institutiones* 52 'Carne densa, quo Calor inhaerens fortius attrahat, et expelat, neve sanguis elabatur'.

<sup>32</sup> Laurentius Andreas, *Historia humani corporis* (Paris, Mettayer and Ourry: 1600) 331 'Cur enim in renes potius, quam in alias partes decumberet serum, nisi peculiaris adesset renum tractus?'

<sup>33</sup> Laurentius, *Historia anatomica* 327–332.

also drew extensively on DuLaurens, which helps explain why his treatment of the kidney in those lectures is quite traditional. Like his authorities, Harvey showed little interest in the structure of the organ itself: he dismissed it as simply a hard, compact substance very much like that of the heart, of a dull reddish colour. He expressed relatively little interest in the process by which urine is formed. Harvey accepted DuLaurens' conclusion that a number of forces concur in its expulsion, including attraction, though there are hints that he would have liked to explain attraction through 'Natural Heat' directed by nature. He commented on the branching of the renal vessels and on the renal pelvis as encompassing the *papillae* but without reflecting on the process of filtration, merely wondering to himself, as his abbreviated notes say, whether 'the [*papillae*] void urine as infants [take] milk; wherefore expulsion of urine rather by attraction of these than of the kidneys; wherefore kidneys, just as breasts for the infant, serve to receive the moisture, which must be sucked out through the papillae'.<sup>34</sup> This is so terse as to be something of a muddle, but Harvey too still clearly located a principle of attraction in the kidney.<sup>35</sup> Indeed, he seems to have been thinking about localising the principle in the *papillae*.

It perhaps scarcely needs to be emphasised that throughout the sixteenth century both the language in which the kidney's action is described and the specific model that is assumed to embody its activity persist, with almost no change. For all our authors, the kidney is an entity that separates a thin fluid – the serum or urine – from a thicker one – the blood – by filtering (*colare, excolare*) it off. They almost universally speak of the organ as itself being a filter, a *colatorium*. No obvious filter could be seen there, aside from the dense substance of the kidney, and one or two

<sup>34</sup> Harvey William, *Lectures on the Whole of Anatomy. An Annotated Translation of Prelectiones anatomiae universalis* (Berkeley: 1961) 122. Harvey's original Latin is given in *The Anatomical Lectures of William Harvey*, ed. Whitteridge G. (Edinburgh-London: 1964) 170 'Emingunt urinam ut infans lac, unde urinam expulsam potius attractione horum quam renum; unde renes tanquam ubera infanti inserviunt ad accipendum humidum quod per papillas exugendum'. I have chosen not to use Whitteridge's freer translation: 'The calyces suck out [she emended the manuscript's *emingunt* to *emulgent*] urine as an infant does milk for which reason it could be said that the urine is driven out by the attraction of the ureters rather than of the kidneys and that the kidneys serve like paps to the babe, collecting the liquid which is to be sucked out through the papillae' (171).

<sup>35</sup> Earlier Harvey, perhaps elaborating on Bauhin's suggestion, wrote: 'As to whether [the urine] moves by attraction or expulsion etc., the answer in one word is that the originator of everything in the body is innate heat [...]. Innate heat as it concocts both attracts and expels ('calidum nativum ut concoquit attrahit expellit'); Harvey, *Anatomical Lectures* 162/163. See also Shank, "From Galen's Ureters" 341–342.

authors (like Berengario) thus rejected the noun, but even they could not resist the verb. In any case, it is clear that no one conceived of the kidney as a sieve (*cribrum*), a sorter-out of particles – quite the contrary; that was an image that non-professionals might loosely use (Zerbi) or that might be employed to lampoon ignorant colleagues (Vesalius), but that made no intellectual sense at all to any of the sixteenth-century writers we have found trying to account for renal physiology.

*The seventeenth century: Riolan and the unit kidney*

This can serve as an introduction to my unlikely protagonist, Jean Riolan the Younger. Trained in part by his father, Riolan was appointed to a new chair of anatomy at the University of Paris (and to a chair of medicine at the Collège Royale) in the first years of the seventeenth century – at exactly the moment, in fact, when André DuLaurens, towards the end of his life, came to Paris as royal physician. Riolan inherited his father's hostility to the new chemical medicine of the day and wrote vigorously against it, and as an anatomist too was committed to ancient medicine and to Galenism; in this respect he is very much like DuLaurens. But he was a much better anatomist than DuLaurens, and in trying to understand the newly emerging anatomical detail he trusted his own scrupulous observations; he kept up with modern discoveries all his life (he died in the same year as Harvey, 1657), accepting many of them, those at least which he could integrate with Galenic theories, and to some extent developed a reputation as a trustworthy arbiter in these matters, which made his criticism of the circulation in the 1640s more than a trivial matter.<sup>36</sup>

Riolan wrote a general survey of human anatomy, his *Anthropographia*, in 1618, when he had just turned forty. A new edition (one that Harvey knew and drew on in revising his Lumleian notes) appeared in 1626, enhanced by a great many new references to classical and modern authorities, but its core description of the kidney and its function was almost exactly as it had been eight years before.<sup>37</sup> It is naturally a generally Galenic account

<sup>36</sup> A thoughtful and convincing assessment of Riolan's position is given by Mani N., "Jean Riolan II (1580–1657) and Medical Research", *Bulletin of the History of Medicine* 42 (1968) 121–144.

<sup>37</sup> Riolan Jean, *Ioannis Riolani filii [...] Anthropographia* (Paris, Perier: 1618); idem, *Anthropographia et osteologia* (Paris, Moreau: 1626). The second of these versions was translated into French by Pierre Constant and published in vol. I of Riolan's *Œuvres*

of how the body works, and with respect to the function of the kidney in particular Riolan offers no challenges at all to Galen's explanations. And yet his account of renal physiology feels somehow different from Bauhin's or DuLaurens'. Something has been happening in the years around 1600, and I suggest that it centred on three things. The first was an acceleration of anatomical knowledge, not just clarifying Galenic descriptions but adding new features, often at a much finer level of detail, forcing scientists to make sense of these new smaller features, somehow, in terms of the prevailing explanatory models. As regards the kidney, the tradition had been to posit attraction as a property of its undifferentiated substance; but as the kidney was observed more closely, and as more of its structure was appreciated, the possible ground or locus of its attractive power became smaller and smaller. The other two of my changes are already prefigured in Galen's own physiology: an appeal in the first instance to commonplace concrete models as analogies to bodily structures, and the use of experiment to test or confirm such models. I make no claim to be saying anything particularly new, because all these things are well-known features of Harvey's investigation of the heart; but it is worth pointing out that they are all also features of the way Riolan is now looking at the kidney. Let me take them up individually.

(1) It is clear from Riolan's account that he is closely familiar with the structures of the renal sinus, especially the pelvis. He has read about them in Berengario da Carpi, he says, but he has examined them for himself: he describes opening the ureter, carrying his exploration up into the renal pelvis, and following it up its branches to see, at their ends, nine or ten fleshy points – *extremitates carneas acuminatas* – where the blood is 'separated from the serum'.<sup>38</sup> These of course are the renal *papillae* (indeed, he refers to them as *carunculae papillares*). Riolan was not alone in commenting upon them and wanting to find a function for them; we know that DuLaurens had over-hastily concluded that they were the actual loci where blood vessels were connected to the ureters. An increasingly refined anatomical knowledge of the post-Mondino kidney was creating pressure for more detailed physiological explanations – and obviously this was the case in the pre-history of the circulation too, when for example

---

*anatomiques* (Paris, Moreau: 1628–1629), but this translation is often very free. In my notes below I give the page reference to the 1618 edition, sometimes adding a reference to the 1626 edition in parentheses).

<sup>38</sup> Quoted below, n. 43.

the discovery of the venous valves immediately forced their interpretation in Galenic terms.

However, from some other source – certainly not Berengario, conceivably his own explorations, though I have not pressed the search for predecessors – Riolan is now aware that the outer part of the kidney is dark in colour, while the inner part is a lighter red, and he thinks it important to say so.<sup>39</sup> That is to say, the kidney is not just a single unexamined ‘substance’ any longer for Riolan, as it still was even for Harvey, for example. I take this to be a recognition of real importance. Riolan is clearly distinguishing between cortex and medulla, and even more importantly he concludes from what he sees that the medulla is composed of ‘glands’ (claiming the authority of Hippocrates’ *On Glands*), which are like individual kidneys.<sup>40</sup> The importance of these ‘glandular’ structures evidently grew on him between 1618 and 1626, because to the later edition he added citations from Arataeus and Hippocrates to reinforce and even extend his account. They are independent in babies, he says, but they grow together to combine into a single organ in an adult. He seems to be talking now not just of the *carunculae papillares* that drip urine into the pelvis but of the medullary pyramids behind them – there are between 8 and 18 of them in the human kidney, each packed with nephrons that collectively drain, indeed, into the pelvis through a renal *papilla*.

This is taking renal anatomy a long step further, and naturally it forces Riolan to come up with a physiological explanation of these findings. He concludes that it must be *these glands* – not the generalised substance of the kidneys any longer, not DuLaurens’ hypothetical hair-like links between veins and *papillae*, not (as in Harvey’s speculations) the *papillae* themselves – that are the agents ‘in attracting and separating the serosities’. And Riolan even proposes a kind of physical law to explain how the individual glands combine their actions to create kidney function:

Since, as everyone knows, every action depends on contact, the more agents are involved in bringing about a change, the easier that change will be, and the faster the action will take place. And this is why the serum, as it were distributed among so many kidneys, is so quickly separated.<sup>41</sup>

<sup>39</sup> Riolan, *Anthropographia* 248–249 (ed. 1626: 237) ‘Propterea in dissecto per dorsum rene, carnem sublividam corpus renis ambientem observabis; alteram internam rubicundiorē ex glandulis illis simul unitis concretam’.

<sup>40</sup> He would already have been familiar with Aristotle’s statement in *PA* 3.9 that the human kidney is made up of numerous small kidneys.

<sup>41</sup> Riolan, *Anthropographia* 248–249 (ed. 1626: 237) ‘Glandulae autem intus collocatae fuerunt, ut serosa excrementa facilius traherent et secernerent. Quum enim actio contactu



Riolan is consciously reducing action to these individual glands, to what we might call a unit kidney, where 'attraction or separation' actually takes place – and the activity is really constrained spatially. The substance of the kidney is losing ground: the 'black box' of renal action is getting smaller and smaller, and the physical gap or discontinuity between where the blood stops and the urine begins is also shrinking.

(2) Next I want to emphasise the concreteness of Riolan's approach to understanding, his almost automatic appeal to analogies that will allow him to visualise what is going on – and he does not fall back on the traditional image of the *colatorium* or filter. Perhaps it was seeing the inner surface of the kidney pierced by the apertures of the *papillae* that led him to conceive of it instead as a sieve, an *incerniculum seu cribrum*. In 1626 he added quotations from Aretaeus and Rufus of Ephesus to this passage in order explicitly to support this picture of a sieve – 'there are little membranes in the hollow parts of the kidneys, pierced with little pores *in the manner of a sieve*' – apparently insensitive to the fact that the Greek texts of both authors (which Riolan supplied) presented the classical image of filtration instead, *êthmoeidôs*!<sup>42</sup> Yet curiously Riolan makes no appeal whatever to the distinctive function of a sieve – to separate different kinds of particles – to help explain urinary production. Instead, he accounts for the passage of urine out through the *papillae* and into the ureters with two other models: 'the serum comes out of the *papillae*', he says, 'almost in the same way as milk comes out of the nipple, and drips into the branches of the ureter just as lye (*lixivium*) seeps with difficulty through the reed inserted into the neck of its jug'.<sup>43</sup> The second analogy

---

perficiatur, quo plures erunt partes ad immutationem alicuius rei, eo facilius eiusdem rei fiet immutatio, atque tota actio celerius absolvetur. Quare serosus sanguis in plures veluti renes distributus [...] segregatur'. The French translation is somewhat freer: 'puis que c'est une verité cogneuë d'un chacun, que l'action se fait par l'attouchement reciproque des choses agissantes, il demeure pour constant, que plus il y aura de parties ioinctes ensemble en l'alteration et changement de quelque chose: plus le changement en sera soudain, et l'action plustost achevee. Et par ainsi les serositez etans distribuees par les caruncules, comme par autant de petits roignons, sont bien plustost digerees, separees et renuoyees'; Riolan, *Œuvres anatomiques* 1,352–353.

<sup>42</sup> Riolan, *Anthropographia* (1626) 236 'Cavis renum partibus membranulae sunt, *instar cribri* foraminulis plurimis pertusae'. The italics are mine.

<sup>43</sup> Riolan, *Anthropographia* 248 'Videbis carunculas sive extremitates acuminatas, in quibus fit secretio sanguinis a sero, quod ab eis veluti lac e papilla exudat, et in ramulos novem ureteris destillat, eo modo quo lixivium per angustiam dolii foramen stipula obturatum' (the 1626 version is slightly expanded at 236). Again, the French translation is freer: 'les serositez tombent à travers la substance de mamellons presque en la mesme sorte que le lait jaillit hors les mammelles, ou bien en la mesme façon que la lessive tombe

is purely mechanical, depending on open if tortuous passages that permit the flow of liquid, however slowly, but the first is not: Riolan certainly does not think of the breast as a mere filtration device, but as an organ which itself *generates* milk out of blood. It is tempting to wonder, in fact, whether Harvey's analogy between breast milk and urine was derived from reading Riolan's book, though the comparison was also sketched out by Berengario da Carpi. Which model fits the kidney better, the biological or the mechanical?

(3) This leads to my final point, Riolan's use of experiment to decide between his models. The blood arrives at the kidney through the renal vein and artery. Are there anastomoses, hollow channels, between these entrance vessels and the *papillae*, pelvis, and ureters, where the purified urine emerges as if through a straw plug in a bottle; or is the kidney – the *unit* kidney, now – solid, acting through some inherent faculty to generate the urine, like milk? Anastomoses in the kidney would imply a simple physical flow; a solid kidney implies action by the 'substance' of the organ. Riolan puts this to a test, a test that was already there in Berengario, except that Berengario had tried to push fluid through from renal vessels to ureters, as the blood would normally move, whereas Riolan wants to see whether fluid can be pushed *back through* the kidney:

You can test this by injecting a little water into the ureter, or by blowing air into it; this spreads through the substance of the kidney without in any way flowing on into the veins. Thus you will see that the urine must filter through (*percolari*) the very flesh of the kidneys.<sup>44</sup>

That is, though fluid can be forced back into the kidney, there are no channels, no anastomoses, that link the ureters and veins directly and permit easy passage from one to the other; instead, the substance of the kidney is impermeable to a purely mechanical flow.<sup>45</sup>

---

hors son tonneau par les entr'ouvertures d'un bouchon de paille que l'estouppe'; *Œuvres anatomiques* 1,351.

<sup>44</sup> Riolan, *Anthropographia* 249–250 (ed. 1626: 238) 'Deinde animadvertes venam et arteriam cum ramis fistulosis nov<e>m [1626 novem aut decem] ureteris non coalescere, quod explorabis aqua per ureterem iniecta, aut spiritu insufflato, quae per renis substantiam diffundi, nec ullo modo in vasa refluere videbis. Inde cognosces urinam per renis carnem' [1626 add. et carunculas] *percolari*. Once more the French is perhaps over-free: Riolan, *Œuvres anatomiques* 1,355 'l'experience en est aysee en versant un peu d'eau chaude dans l'uretere, laquelle se va soudain respendre par la substance du rein, sans qu'il en enctre la moindre goutte dans les vaisseaux. On esprouve encoure la mesme chose en soufflant dans l'uretere: d'où on cognoit que l'urine passe à travers la substance des reins et des caruncles'.

<sup>45</sup> Here two changes made in the text of the *Anthropographia* between 1618 and 1626 may be significant: Riolan, *Anthropographia* 248 (ed. 1626: 237) 'Eleganter scripsit

This kind of appeal to fluid pressure in a closed system as a demonstrative technique is not unique to Riolan either: it is a commonplace in *De motu cordis*, where it is used for example to confirm the solidity of the cardiac septum, and (by blowing into a glove) to show the equality of fluid pressure throughout an interconnected system. But I would suggest that Riolan's particular experiment was suggested by Galen. In *On the Natural Faculties* Galen had sealed off the urethra, filled the bladder, and tried to force fluid back into the ureters so as to test a one-way flow. That is precisely what Riolan is doing, and he argues the way Galen did: since it is impossible to force fluid back through the system, there is obviously no open and unimpeded communication within it. Galen showed that the insertion of the ureters into the bladder seals off the vessels at that point; Riolan looked a little higher up to show that the substance of the kidney seals them off in exactly the same way. But both authors were offering the results of an experimental test of a restricted mechanical model to confirm their conclusions.<sup>46</sup>

### *Bellini, Malpighi, and the microscope*

With the best will in the world, I cannot say that Riolan revolutionised the study of the kidney: that revolution depended on later developments

---

Hippocrates lib. de ossium nat. per renes [1618 add.: tanquam per quallam] aquam percolari; quia spongiforme est eorum corpus, [1626 add.: et li. de glandulis notat renes habere glandulas, quoniam multa humiditate replentur; maiores vero hac in parte sunt, quam alie glandulae]. It would seem, that is, that in 1618 Riolan may have been thinking of the substance of the kidney as in some sense a mechanically open structure (*qualla* denotes a wicker basket) but had dropped this image by 1626 in favor of the 'glandular' model and a less permeable kidney.

<sup>46</sup> Other historians have commented separately on these three traits' presence in Riolan's physiology, particularly as manifested in his account of the heart's action. (1) Regarding his responsiveness to new anatomical discoveries: Walter Pagel has pointed out that in the 1618 *Anthropographia* Riolan was already drawing on recent observations by Volcher Coiter (1573), as well as his own, to insist (independently of Harvey) on the incorrectness of Realdo Colombo's views and to point out that instead the heart beats in systole and that it is at that moment that the arteries dilate; Pagel W., *William Harvey's Biological Ideas* (New York: 1957) 216–218. (2) With regard to his wider use of analogies: again in the *Anthropographia*, Riolan likened the motion of the heart in diastole and systole to a bellows, 'Cor instar follii distendi et comprimi' (ibidem 212 n. 11, where Pagel quotes the phrase from the *Anthropographia* in its 1626 edition; I have not been able to confirm that the simile was already present in the 1618 edition). (3) On Riolan's attitudes towards physiological experimentation (well after the publication of the *Anthropographia*, however), see Mani, "Jean Riolan II" 139–142.

that he observed but could never appreciate. One was Harvey's account of the circulation of the blood, which required investigators to rethink how blood came to (and left) the body's various organs. Another was the growth of mechanism more generally, of a predilection for explanations of natural phenomena that were based solely on matter and motion, and increasingly couched in corpuscularian terms. And a third, just beginning to gain importance at the time of Riolan's death in 1657, was the use of the microscope in scientific investigation. In a sense, the man who launched a revolution in the study of the kidney was Giovanni Borelli, who by the 1650s was deeply committed to a search for mechanistic explanations in physiology and was able to appreciate the potential of the microscope, so that he encouraged a young protégé, Lorenzo Bellini, to apply the microscope to the investigation of renal anatomy. As a result, Bellini was able to see that the kidney was in fact made up of a mass of 'fibres' which, when compressed, emitted a salty fluid – as he reported in his *Exercitatio anatomica de structura et usu renum* (1662) – and he recognised that these were probably the channels by which urine passed out of the organ.

As for the mechanism of urine production, however, after reviewing the theories proposed by earlier authors, Bellini deferentially reported his master's views. Not surprisingly, Borelli approached the problem as a mechanistic-corpuscular one, and tried to devise a renal mechanism for discriminating between particles of blood and particles of serum or urine: in effect, therefore, he was from the outset postulating a sieve (though he never uses the word) and not the traditional filter. Borelli was a Harveian, and accepted that blood came to the kidney through the renal artery and left through the renal vein; but how and where was the urine removed? He proposed that since ink forced into both the renal artery and the renal vein could be seen exuding from the kidney's cortex (once the organ's surrounding capsule was removed), both artery and vein must terminate there in fine vessels, and he supposed that they meet Bellini's fibers there in what we might imagine as a number of Y-joints.<sup>47</sup> Blood would be pumped in through the artery, and at the Y the serum would pass out through the fibers while the remainder of the blood would continue on

---

<sup>47</sup> Borelli's account is summarised in Bertoloni Meli D., "The Collaboration between Anatomists and Mathematicians in the mid-Seventeenth Century with a Study of Images as Experiments and Galileo's Role in Steno's Myology", *Early Science and Medicine* 13 (2008) 682–684. I have consulted the text of Bellini's work as given in Grondona F., "L'esercitazione anatomica di Lorenzo Bellini sulla struttura e funzione dei reni", *Physica* 5 (1963) 423–463.

into the vein. But how could the specific separation be explained without appealing to a specific attracting force? Borelli offered a two-phase explanation. First, the blood could be drawn into the tiny veins and the serum into the fibres by an action like that evident in the capillary tubes that were then an object of European study; second, by positing, not different sizes, but different configurations for the two kinds of channels, one could explain the organ's discrimination between the two fluids.

This second aspect of Borelli's solution was not improbably meant to evade the objection first raised by Galen in *On the Natural Faculties*, that differences in channel size could not possibly account for separation of particles because the smallest particles would pass through large and small channels alike. Indeed, without mentioning Galen, Borelli conceded this point when he denied that the veins and the fibers can be differentiated functionally by the size of their openings and offered new examples that were in fact an extension of Galen's position:

For it can be demonstrated by many experiments that very narrow apertures will not allow subtle substances to pass through, even though thicker ones do; and further that subtle things cannot enter lax and yielding apertures, although less subtle ones do so. Thus: how narrow must the pores in gold be! they escape the senses entirely, and some maintain that they are not to be found – yet mercury can pass into those pores, which neither water nor air nor other things much finer than mercury can enter. Further: of what [tiny] breadth must the pores in bladders and skins be! Even so, while water sweats through them, they do not permit the passage of the thinner air.<sup>48</sup>

These facts show that channel size cannot be depended on to determine what particles do and do not pass through them, but they do not help us understand what *does* determine it.

Borelli's answer is perhaps less fully worked out than it might have been. It must be, he concludes briefly, that the particles of blood and serum are shaped differently and exactly fit, respectively, the shapes of the openings of the veins and fibers, and are thus sorted apart without any need for principles of attraction or familiarity – but he does not try to pursue the

---

<sup>48</sup> Grondona, "L'esercitazione" 461 'Nam plurimis experimentis comprobari posset, poros angustissimos a rebus subtilioribus non penetrari, licet ipsos crassiora pervadant; rursusque, a poris satis patientibus et laxis subtilia non admitti, quamvis minus tenuia introducantur. Sic quanta sunt angustiae auri porositates? adeo illae sensum effugiunt, ut prorsus non reperiri aliqui contenderint; et tamen mercurius poros illos penetrat, quos non aqua, non aer, nec ulla hydrargiro subtiliora possunt pervadere. Rursus, quanta sunt amplitudinis pori vesicarum, et pellium? Ab his tamen exsudat aqua, licet exitum aeri tenuiori nunquam concedant'.

implications of this model under the mechanical hypothesis. For example, it would seem to presume a corollary assumption that he does not state, that the various kinds of particles are all roughly comparable in size, since if the particles of air were truly 'much finer' than those of mercury they should be able to slip through the apertures in gold whatever their shape. In any case, Borelli has thus made of the configured 'Y-joints' the kind of sieves he was looking for, inasmuch as they are separating particles from particles and not liquids from solids.

By this same time glands had become an increasingly interesting focus of attention in the seventeenth century, especially to the mechanistically inclined. The Hippocratic *On glands*, though included in Zwinger's collection of Hippocrates' writings (1579), was for a long time very little cited by Latin authors, perhaps because it was a rather difficult text, perhaps because it had little relevance for medical practice.<sup>49</sup> It directed attention to a number of distinct spongy entities distributed through the body, which it supposed were designed to attract or drain off moisture from the body. It called particular attention to the glands in the axillae and tonsils, but it recognised that glands were to be found associated with the kidneys, among other organs:

The kidneys, too, have glands, since they also are saturated with much moisture. The glands there are larger than the other glands for the moisture that flows in is not soaked up by the kidneys, but flows through them down to the bladder, so that whatever the glands acquire from the pipes they draw to themselves.<sup>50</sup>

The language of the text is not particularly specific. There is no obvious reason today to identify Hippocrates' renal glands with any particular modern anatomical entity, whether (for example) the adrenal glands (located on top of the kidneys) or the aortic lymph nodes.<sup>51</sup> Its vagueness had made it easy, as we have seen, for Riolan to assume that Hippocrates had been referring to the pyramidal entities Riolan had seen within the kidneys, and thus to claim classical authority for these new features.

Hippocrates' suggestion of the glands' role in collecting moisture, reinforced by their evident vascular connections, encouraged the thought that they might be the body's principal agents in the mechanical distribution

<sup>49</sup> See the paper by Elizabeth Craik in this volume.

<sup>50</sup> Hippocrates, *De glandulis* 6 (113 Potter; 8.560 L.).

<sup>51</sup> Crivellato E. – Travan T. – Ribatti R., "The Hippocratic Treatise 'On Glands': The First Document on Lymphoid Tissue and Lymph Nodes", *Leukemia* 21 (2007) 591.

and segregation of humours or fluids. The assumption of the body as glandular machine guided Marcello Malpighi's own microscopical investigations in the early 1660s and led him to proclaim that glands were to be found in many of the chief organs of the body – liver, kidney, brain, and spleen – though he could say little about their structure or operation.<sup>52</sup> The tendency among historians today is to see Malpighi as becoming less committed to mechanical explanations in his later life, but certainly in 1666, when his *De renibus* appeared, the machine served him as an *a priori* model. To say, as Guido Giglioni has, that for Malpighi 'the *a priori* dimension of knowledge never supersedes the decisive role of the observation',<sup>53</sup> is difficult if not impossible to reconcile with his original account of the operation of the kidney.

The *De renibus* (part of Malpighi's wider *De viscerum structura*) is a deservedly famous work, arguably standing to the kidney as Harvey's *De motu cordis* does to the heart; and in part it follows naturally from the Harveian circulation, which Malpighi too accepts: once blood is understood as pumped in to the kidneys through the renal arteries and brought out through the renal veins, Aristotle's first phase has been automatically mechanised, and no longer needs attraction to be explained. But the second phase, the separation of urine from blood, had become an independent problem in the Renaissance, and Malpighi's investigation of *that* problem is shaped by the same three explanatory factors already visible in Riolan: an increasing knowledge of the detailed structure of the kidney; an appeal to concrete analogies that carry with them functional implications; and the experimental testing of those implications through their consequences. Again, let us look at them one at a time.

(1) An increased knowledge of kidney structure was the most dramatic contribution made by Malpighi, who had been looking at anatomical features with the new microscope since the 1650s. Riolan's naked-eye observations, remember, revealed the cortex and medulla, and postulated the pyramids as centres of action. Malpighi was now able to see and describe 'little canals' in the cortex that were continuous with the bigger blood vessels, as he could demonstrate by injections of ink. He could see excretory

---

<sup>52</sup> Bertoloni Meli D., "The New Anatomy of Marcello Malpighi", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 45–51; and Giglioni G., "The Machines of the Body and the Operations of the Soul in Marcello Malpighi's Anatomy", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 152–153.

<sup>53</sup> Giglioni, "Machines" 158.



canals running up from the centre of the kidney, and tiny glands attached like apples to the little canals, 'the latter swollen with the black liquid and stretched out into the form of a beautiful tree':<sup>54</sup> these were the glomeruli. The kidney would never be undifferentiated substance again.

(2) My second feature, the spontaneous appeal to analogies to embody observations, is already apparent in Malpighi's apples, his little canals, his beautiful tree. Yet he was curiously cautious about proposing a model to explain how urine was excreted. I think the image of the mechanical sieve must have seemed inescapable to him, because he takes for granted that earlier writers had espoused it and never recognises that until Borelli they had been thinking instead of the kidney as a filter; yet he himself resists using the term. It was always *others* who spoke that way: it was the 'ancients', he writes at the beginning of his work, who imagined the kidney to be a *cribri species*;<sup>55</sup> later he says 'it is absolutely true that the urine is *not* separated by the *papillae*, as by a sieve' (that had been DuLaurens' view).<sup>56</sup> And so forth. The impression that Malpighi thinks this may be too crude a model is confirmed when he turns to reflect on the possible function of the tiny glands that he has discovered linking blood vessels and canals:

It is obvious that this mechanism (*hanc machinam*) accomplishes the work of separation of the urine by its internal arrangement. But whether this arrangement is similar to those devices which we make use of here and there for human needs, and in imitation of which we build rough contrivances, is doubtful. For although similar sponge-like bodies, structures with sieve-like fistulae (*incerniculi fistularum cribrorumque structurae*), may be encountered, it is difficult to determine to which of these the structure of the kidneys is similar in all respects. And since the manifestation of Nature's working is most varied, we may discover mechanisms (*machinae*) which are unknown to us and whose operations we cannot understand.<sup>57</sup>

We cannot help admiring the thoughtfulness of these reflections, but in fact Malpighi does not live up to his call for caution and almost immediately returns to the simplicity of the traditional model. He agrees that foreign particles of different sizes and shapes can sometimes be found passed in the urine, which is perhaps his way of conceding that pore-size

<sup>54</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 251.

<sup>55</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 245.

<sup>56</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 256 *Verum absolute sit urinam nequaquam papillari corpore, ut cribro, separari a vasis sanguineis.*

<sup>57</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 259–260.

cannot explain the differential secretory power of different glands – and yet, he goes on, ‘as I think, Nature has made the structure of these glands very small and most simple, so that we cannot doubt that [...] whatever is of larger size or of different shape does not enter the little pores and small spaces of the excreting body, and is not excreted’.<sup>58</sup> He still resists using the word itself, but the model of the sieve is irresistible, whatever difficulties it may entail.

(3) Finally, like Riolan, like Galen, Malpighi wants to put his model to the test, and the test is the same: can the anastomoses, the connections (now narrowed down to the tiny glomeruli), be experimentally demonstrated? He tried perfusing ink into the arteries, and it coloured the glands but went no further; he tried perfusing it into the ureter, and could not even get it to colour the canals. Apparently ink could not go from one side to the other, in either direction. Hence Malpighi tried to verify his model with a different experiment, by putting pressure on the kidney as a closed system. He tied off the renal vein, and the ureter as well, but he left the artery open to keep pumping in blood; he hoped in this way to force fluid across the filter he supposed was present in the glands. It was essentially the same experiment as Riolan’s, or Galen’s experiment with the sealed-off bladder. If we put pressure on a fluid in a container, and it does not escape, it demonstrates that the system is watertight; both Galen and Riolan accepted this mechanistic argument as proving that there was no channel for urine through the kidney. Malpighi, on the contrary, hoped to show that the system *was* open, that the glands *would* allow passage of fluid under high pressure. After having thus forced more and more blood into the kidney, he opened the organ and looked at his glands, where ‘I seemed to see a certain connection and continuation, but not such as satisfied the senses in all particulars’. All his experiments, in fact, had confirmed Riolan’s conclusion, the imperviousness of the kidney.<sup>59</sup>

Yet Malpighi did not despair. ‘Reason can bring assistance’, he went on soothingly, for if the material of the urine is derived from the arteries, and the arteries end in the glands, and the canals start there and drain urine into the pelvis, ‘there must of necessity be granted a continuity and communication between them’.<sup>60</sup> The model was now so powerful that it outweighed the experimental evidence itself. Like Riolan, like Galen,

<sup>58</sup> Hayman, “Malpighi’s ‘Concerning the Structure of the Kidneys’” 260.

<sup>59</sup> Hayman, “Malpighi’s ‘Concerning the Structure of the Kidneys’” 252–253.

<sup>60</sup> Hayman, “Malpighi’s ‘Concerning the Structure of the Kidneys’” 253.

Malpighi used experiment and mechanical reasoning to test his model, but he no longer felt bound by the outcome of the test. Reason, applied to these anatomical structures, was more powerful, and I think this may be because the microscope had reduced the ground or locus for the creation of urine, in effect, to a point – or to a huge number of points. Now there are thousands and thousands of unit kidneys at work producing urine, not just a dozen or so as in Riolan, and each of them is terribly *insubstantial*. It was evidently easier for Malpighi to imagine each one as a sieving device than as a centre of physical attraction, as a point of active separation and transport across an otherwise impenetrable barrier – no matter what his experiment seemed to show.

While it is no part of this paper to consider Malpighi's later thinking about the kidney and about his subsequent exchanges with Borelli on the subject,<sup>61</sup> it is certainly appropriate to compare the ways in which the two were attempting to model the kidney's action in the early and mid-1660s. Both approached it with mechanistic preconceptions, both found the image of the sieve virtually inescapable, and both used experiment to test and hopefully to confirm those preconceptions by injecting fluids into the organ through its artery and vein: Borelli inferring from the fluids' appearance at the kidney's periphery that the vessels must be connected there, Malpighi observing that connection through the microscope and attempting unsuccessfully to force fluid from one side to another. His failure to do so did not weaken his *a priori* commitment to a mechanistic explanation of kidney function; this Malpighi of 1666 is the one recognisable in Theodore M. Brown's seminal 1968 dissertation, however much historians now believe he may have moderated and nuanced his views in later life.<sup>62</sup>

Equally, however, I think that both iatromechanists were still uneasy about their answer to the old Galenic objection based on the fact of selective excretion. Borelli had tried to explain it by particle shape, without acknowledging that particle *size* still had to be taken into account. Malpighi seems to have recognised this omission when he proposed that the corpuscles of the materials to be excreted must somehow assemble into a larger corpuscle (*in unam quasi coire molem*) of exactly the shape and size to fit the urinary tubules.<sup>63</sup> Both these explanations require unspoken

---

<sup>61</sup> Bertoloni Meli D., "The Posthumous Dispute between Borelli and Malpighi", in Bertoloni Meli (ed.), *Marcello Malpighi* 247–275, esp. 253, 259–261.

<sup>62</sup> See Brown T.M., "Reflections on a Changing Field", in Bertoloni Meli (ed.), *Marcello Malpighi* 7.

<sup>63</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 260.

assumptions or principles of action that cannot be obviously derived from a mechanistic hypothesis, and if Borelli and Malpighi recognised that fact, it would surely have left them uncomfortable. Indeed, Malpighi's appeal to fermentation as possibly playing a role in the preparation of the excreted bodies strikes me as little more than 'hand-waving' designed to paper over gaps that he recognised still existed in his explanation.<sup>64</sup>

Certainly other contemporaries recognised that this selectivity represented an obstacle to a mechanistic explanation of the excretion of urine, and not only physicians. Isaac Newton is one figure who seems to have found in it an insuperable objection to the kidney-as-sieve hypothesis. Archibald Pitcairne's record of his discussions with Newton in March 1692 about the implication of acidity for the structure of matter describes the power of mercury to penetrate the pores in gold, and explains that 'difference of shape in pores makes no difference because the pores are much wider than the particles of liquid entering them'; indeed, one might wonder whether the two might actually have been talking about Borelli's own argument drawn from Bellini's discovery, especially because in the same connection Pitcairne also recorded Newton's conviction that 'Urine is secreted through small passages in the kidneys (*tubulos renales*) because it is attracted to these passages and has affinity with them'.<sup>65</sup> Still, Newton's privately expressed view was not that of the medical world, which for the most part found a generally mechanistic interpretation of kidney function to be satisfactory.<sup>66</sup>

And that is how the principle of selective separation of the blood's components, as produced by differential attraction, disappeared from renal physiology, and a process of mechanical sieving came to dominate explanations. Or did it? What *does* happen in a kidney, anyway? If there is anything like a sieve there, it would be the cell walls in the glomerulus.

---

<sup>64</sup> Hayman, "Malpighi's 'Concerning the Structure of the Kidneys'" 260–261. As Bertoloni Meli puts it, somewhat more positively ("Posthumous Dispute" 274): 'A tool repeatedly used by Malpighi to bridge the gap between the mechanico-philosophical programme and the outcome of specific investigations was the notion of fermentation' (and cf. 253, 260).

<sup>65</sup> Newton Isaac, *Correspondence*: ed. Turnbull H.W. (Cambridge: 1961), vol. 3, 211: nos. [8], [14], [12].

<sup>66</sup> Cf. Siegel, *Galen's System* 132. Guerrini A., "The Varieties of Mechanical Medicine: Borelli, Malpighi, Bellini, and Pitcairne", in Bertoloni Meli (ed.), *Marcello Malpighi* 125–127, discusses Pitcairne's own views on urinary excretion as they stood in the 1690s: 'he ignored the anatomical evidence Malpighi and others had used to substantiate the "strainer" theory of secretion, arguing from mathematics and logic rather than experimentation', but in the end adopted a version of the model – originating with Borelli – that made the specificity of excretion dependent on the configuration of the tubule.

Water can always pass across these walls, and under pressure it will, carrying small molecules and ions but leaving big proteins behind – filtering the blood, one could certainly say. But as this fluid passes into the renal tubule, it is subject to forces other than hydrostatic: *active* transport carries these solutes *back* into the blood, and water follows with them; it is the body's way of regulating glucose and ions, especially sodium, so as to maintain a constant internal environment: that is, there are selective processes (I hesitate to say mechanisms) ensuring that some chemicals are eliminated and others not, for reasons distinct from particle size. That was the theme of the paper that my name appeared on so long ago: we were able to show where, specifically, ammonium ions are singled out for active transport back into the blood. The kidneys sieve out the plasma more or less mechanically, passively, but then by active processes they draw many of its components, including water itself, back into the blood. Taking the long view, in fact, one could argue that Galen was more perceptive than Malpighi: the kidney is not a pure machine, rather, it combines mechanical with actively attractive processes as it produces urine out of blood. But I hardly imagine that I will be able to convince renal physiologists that Galen and not Malpighi is the founder of their subject.

*Selective bibliography*

- ARISTOTLE, *De partibus animalium*: tr. Ogle W., *The Works of Aristotle* (Oxford: 1912), vol. 5.
- BAUHIN CASPAR, *Institutiones anatomicae corporis virilis et muliebris historiam exhibentes* (s. l. [Lyons], Le Preux: 1604).
- BERENGARIO DA CARPI, *Anatomia Carpi* (Venice, Bern. de Vitalibus: 1535).
- , *Commentaria Mundini* (Bologna, H. de Benedictis: 1521).
- BERTOLONI MELI D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997).
- , "The Collaboration between Anatomists and Mathematicians in the mid-Seventeenth Century with a Study of Images as Experiments and Galileo's Role in Steno's Myology", *Early Science and Medicine* 13 (2008) 665–709.
- , "The New Anatomy of Marcello Malpighi", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 21–62.
- , "The Posthumous Dispute between Borelli and Malpighi", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 247–275.
- BROWN T.M., "Reflections on a Changing Field", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 3–17.
- CRIVELLATO E. – RIBATTI R., "The Hippocratic Treatise 'On glands': The First Document on Lymphoid Tissue and Lymph Nodes", *Leukemia* 21 (2007) 591–592.
- DAREMBERG C. – SAGLIO E., *Dictionnaire des antiquités grecques et romaines*, 5 vols. (Paris: 1875–1919).
- DE SANTO N.G. – BISACCIA C. – DE SANTO R.M. – TOUWAIDE A., "The Pre-Vesalian Kidney: Gabriele Zerbi, 1445–1505", *American Journal of Nephrology* 22 (2002) 164–171.
- DE SANTO N.G. – DE SANTO L.S. – DE SANTO R.M. – DI LEO V.A. – PAPALIA T. – CIRILLO M. – TOUWAIDE A., "Berengario da Carpi", *American Journal of Nephrology* 19 (1999) 199–212.
- DULAURENS ANDRÉ (A. Laurentius), *Historia anatomica humani corporis* (Paris, Mettayer and Ourry: 1600).
- GALEN, *De facultatibus naturalibus*: tr. Brock A.J. (1916), *On the Natural Faculties*, London – New York [Loeb].
- , *De iuvamentis membrorum* (Venice, Pincius: 1490) [*Opera Galieni*].
- , *De locis affectis*: tr. Siegel R. (1976), *On the Affected Parts*, Basel-New York.
- , *De usu partium*: tr. May M. (1968), *On the Usefulness of the Parts of the Body*, 2 vols, Ithaca NY.
- , *De virtutibus naturalibus* (Venice, Pincius: 1490) [*Opera Galieni*].
- , *Opera omnia*: ed. Kühn C.G., 20 vols. (Leipzig: 1821–1833).
- GIGLIONI G., "The Machines of the Body and the Operations of the Soul in Marcello Malpighi's Anatomy", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 149–174.
- GRONDONA F., "L'esercitazione anatomica di Lorenzo Bellini sulla struttura e funzione dei reni", *Physis* 5 (1963) 423–463.
- , "Strutturistica renale da Galeno al Highmore", *Physis* 5 (1963) 173–195.
- GUERRINI A., "The Varieties of Mechanical Medicine: Borelli, Malpighi, Bellini, and Pitcairne", in Bertoloni Meli D. (ed.), *Marcello Malpighi. Anatomist and Physician* (Florence: 1997) 111–128.
- GUINTER JOHANNES, *Institutionum anatomicarum secundum Galeni sententiam libri quatuor* (Paris, Colin: 1536).
- , *Institutionum anatomicarum secundum Galeni sententiam libri quatuor* (Venice, Bernardinus: 1538).
- HARVEY WILLIAM, *Lectures on the Whole of Anatomy; An Annotated Translation of Prelectiones anatomiae universalis*, trs. O'Malley C.D. – Poynter F.N.L. – Russell K.F. (Berkeley: 1961).

- , *The Anatomical Lectures of William Harvey*, ed. G. Whitteridge (Edinburgh-London: 1964).
- HAYMAN J.M. JR., "Malpighi's 'Concerning the Structure of the Kidneys': A Translation and Introduction", *Annals of Medical History* 7 (1925) 242–263.
- HIPPOCRATES, *De glandulis*: ed. Potter P. (1995), *Glands*, Cambridge, Mass. [Loeb Classical Library, Hippocrates, vol. 8].
- KETHAM JOANNES, *The Fasciculo di medicina, Venice, 1493*, ed. Singer C., 2 vols. (Florence: 1925).
- MALVIN R.L. – SULLIVAN L.P., "Stop-flow Technique: A Brief Episode in the History of Renal Physiology", *News in Physiological Sciences* 5 (1990) 180–182.
- MANI N., "JEAN RIOLAN II (1580–1657) and Medical Research", *Bulletin of the History of Medicine* 42 (1968) 121–144.
- MARANDOLA P. – MUSITELLI S. – JALLOUS H. – SPERONI A. – DE BASTIANI T., "The Aristotelian Kidney", *American Journal of Nephrology* 14 (1994) 302–306.
- MCVAUGH M., "The 'Experience-Based Medicine' of the Thirteenth Century", *Early Science and Medicine* 14 (2009) 105–130.
- MONDINO DEI LIUZZI, *Anatomia* (Pavia, de Carcano: 1478).
- NEWTON ISAAC, *Correspondence*: ed. H.W. Turnbull, 7 vols. (Cambridge: 1959–1977).
- PAGEL W., *William Harvey's Biological Ideas* (New York: 1957).
- RIOLAN JEAN, *Anthropographia* (Paris, Perier: 1618).
- , *Anthropographia et osteologia* (Paris, Moreau: 1626).
- , *Œuvres anatomiques*, 2 vols. (Paris, Moreau: 1628–1629).
- SHANK M.H., "From Galen's Ureters to Harvey's Veins", *Journal of the History of Biology* 18 (1985) 331–355.
- SIEGEL R.E., *Galen's System of Physiology and Medicine* (Basel-New York: 1968).
- SULLIVAN L.P. – MCVAUGH M.R., "Effect of Rapid and Transitory Changes in Blood and Urine pH on NH<sub>4</sub> Excretion", *American Journal of Physiology* 204 (1963) 1077–1085.
- VESALIUS ANDREAS, *De humani corporis fabrica* (Basel, Oporinus: 1543; repr. Brussels: 1964).
- , tr. Richardson W.F. in collaboration with Carman J.B. (2007), *On the Fabric of the Human Body. Book V, The Organs of Nutrition and Generation*, Novato, CA.
- WICKERSHEIMER E., *Anatomies de Mondino dei Luzzi et de Guido de Vigevano* (Geneva: 1977).





THE ART OF THE DISTILLATION OF 'SPIRITS' AS A TECHNOLOGICAL  
MODEL FOR HUMAN PHYSIOLOGY.  
THE CASES OF MARSILIO FICINO, JOSEPH DUCHESNE  
AND FRANCIS BACON

Sergius Kodera

*Summary*

This article concerns the role of the distillation apparatus for the production of alcohol in early modern physiological discourses. Here, the still had an amazingly powerful explanatory potential, and this is especially true for the elusive concept of medical *spiritus*. My text investigates the function of the art of distillation in different authors who were interested in the workings of human, and of celestial, bodies. Marsilio Ficino (1433–1499) used the still as an explanatory foil for his Neoplatonist metaphysics, which entailed important and highly influential modifications of Aristotelian natural philosophy. In contrast to Ficino's predominantly theoretical approach, Joseph Duchesne (1546–1609), a French Paracelsian, gives a highly detailed description of the practical aspects of the art of distillation of liquors, which relates to his concept of human physiology. Francis Bacon (1561–1626) uses a modification of the still to quantify the medical *spiritus* but also to further elaborate the Paracelsian and the Neoplatonic concepts of physiology.

The distillation of 'spirits' seems to have been invented at some point during the twelfth or thirteenth centuries;<sup>1</sup> the Florentine Taddeo Alderotti (ca. 1223–1292) called the products generated by the new technology *aqua ardens*.<sup>2</sup> In fourteenth-century Nuremberg, *Hausbrand*, a kind of brandy made from grapes, was sold cheaply by apothecaries, while distillation

---

<sup>1</sup> On the following, see Multhauf R.P., "Distillation" in Strayer J.R. (ed.), *Dictionary of the Middle Ages* (New York: 1984), vol. 4, 219–220, who also discusses the (rather improbable) older origins of the art. Holmyard E.J., *Alchemy* (Harmondsworth: 1957) 51 mentions a certain Salernitanus († 1167) as the inventor.

<sup>2</sup> Ficino uses this term in Ficino Marsilio, *De vita libri tres*, eds./trs. Kaske C.-V. – Clark J.R. (Binghamton, NY: 1989) Book I, 6: 120/1 and Book III, 1: 247. The word 'alcohol' was perhaps introduced by Paracelsus to denote pure wine spirit, but actually refers to the Arabic word for 'black eye-paint'; cf. Holmyard, *Alchemy* 168. Yet Paracelsus also retains the original meaning of the word, as a signifier for 'fine powder'; cf. Pagel W., *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance* (Basel-New York: 1958) 155–156, n. 82.

from beer and grain spirits commenced around the year 1400.<sup>3</sup> The process of distillation of liquors is quite a sophisticated art, which in all probability significantly changed the ways of life of both men and women in late medieval Europe. The must to be distilled, contained in the cucurbit or gourd-shaped vessel, is surmounted by a beak-shaped head or alembic that conveys the vaporous product to a water-cooled device, where the vapours condense and are subsequently led to a receiving vessel. This water-cooled still, which seems to have been a European invention, is a prerequisite for the production of alcohol; the older alembics, known since classical Antiquity, lacked this cooling device.<sup>4</sup> Following the invention of printing, tracts with numerous and detailed illustrations of the new instrument in its amazing varieties ranked amongst the more popular books streaming from early modern European printing presses; apart from producing brandy, and from supplying ingredients for new medicines and tinctures, the novel technique was also praised as a means of extracting the alchemist's *elixir*, a substance that was again closely related to, or even identified with, the celestial aether, the substance of which stars are made.<sup>5</sup>

The technology was, therefore, perceived as being capable of purifying virtually any organic substance from a state of decomposition into a clear and transparent liquor that still preserved recognisable traits of the original material. The alembic was obviously an instrument by means of which one could extract the most characteristic property of a given substance, its essence.<sup>6</sup> As we shall see, this particular perception of the capacities of the still had important consequences for some basic tenets in natural

<sup>3</sup> On the spread of the use of 'Brantwein' in Germany, see Eckstein F., "Brantwein", in Bächtold-Stäubli H. – Hoffmann-Krayer E. (eds.), *Handwörterbuch des deutschen Aberglaubens* (Berlin-Leipzig: 1927–1942), vol. 1, col. 1497–1507, with many references.

<sup>4</sup> For early illustrations and discussion of the principles of the so-called 'Moor's head' and the 'Rose-hat' see Forbes R.-J., *Short History of the Art of Distillation from the Beginnings up to the Death of Cellier Blumenthal* (Leiden: 1948) 83–86; cf. also Holmyard, *Alchemy* 50–51, with illustrations.

<sup>5</sup> On the medical use of *aqua ardens* in alchemical literature, see Pereira M., "Medicina in the Alchemical Writings attributed to Raimond Lull (14th–17th centuries)", in Rattansi P. – Lericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 1–16, esp. 8–9. For a concise introduction to the genre of *aqua ardens* literature, see Debus A.G., *The Chemical Philosophy* (New York: 1977) 20–25.

<sup>6</sup> On this issue, see the interesting remarks in Colnort-Bodet S., "Eau-de vie logique et 'Banqueroutiers du Saint-Esprit'" in Morazé Ch. – Aron R.C.F. (eds.), *Culture science et développement. Mélanges en l'honneur de Charles Morazé* (Paris: 1979) 310–311.

philosophy as well as in medicine;<sup>7</sup> in tandem with such ideas, distillation also served as an explanatory model for various physiological processes that were otherwise difficult to observe. The spectacular effects of high-percentage alcohol on human bodies (and minds alike) provided outstanding evidence of the existence of so-called medical spirits, a traditional and very common explanatory system for physiological phenomena.<sup>8</sup> As will become apparent below, the distillation of alcohol served to give the concept of medical spirits a more prominent role in human physiology. In so doing, this concept eventually eclipsed the importance accorded to the traditional four bodily humours.

On the theoretical plane, these developments were supported and accompanied by Renaissance Neoplatonism. In particular Marsilio Ficino (1433–1499), the most important Hellenist of his day, contributed to the development of a set of physical doctrines that provided an alternative to the peripatetic approaches taught at the universities. Ficino's primary metaphysical concern was to describe the ascent (and its concomitant, potentially dangerous descent) of human souls in the hierarchy of being. This theurgic potential for the refinement of the individual soul (an idea originating in the Neoplatonism of Iamblichus), was a movement that could be predicated upon the entire cosmos. Indeed, according to Neoplatonic theory, all beings were constantly moving up and down the ladder of being, their position being determined by the degree of refinement they could achieve at any given moment in time. I will argue that the new art of distillation of liquors provided an important material confirmation of this idea; furthermore, I will show that Ficino was aware of this technology and that it served as an explanatory foil for his metaphysics as well as for his ideas about the prolongation of life. Some of Ficino's texts were eagerly assimilated by influential sixteenth-century alchemists and beyond. His books also became contested (but well-studied) sources for Neapolitan natural philosophers of the sixteenth century, such as Giordano Bruno, Tommaso Campanella or Giambattista della Porta. The latter's ideas about distillation will be briefly treated here as an example of the approach taken by this Italian school of thinkers.

---

<sup>7</sup> On the extraction of celestial essences by the virtue of fire in Paracelsian medicine, see Hannaway O., *The Chemists and the Word. The Didactic Origins of Chemistry* (Baltimore-London: 1975) 42.

<sup>8</sup> On the relationship between distillation and *spiritus* in Renaissance medicine, see Putscher M., *Pneuma Spiritus Geist. Vorstellungen vom Lebensantrieb in ihren geschichtlichen Wandlungen* (Wiesbaden: 1974) 62f.; Taylor F.S., "The Evolution of the Still", *Annals of Science* 5 (1945) 117–121; Hannaway, *The Chemists* 27–29.

*Quintessences, medical and alcoholic spirits*

In a way, it is by no means surprising, and is indeed to be expected, that distillation of alcohol became such a spectacular art: liquor is still called *aquavit[ae]*, or water of life, in many languages.<sup>9</sup> When administered to undernourished patients, alcoholic spirits have spectacular effects, so they quickly became identified as a sort of general medical remedy that had also the capacity to prolong life. This miraculous form of *theriac* is praised, for instance, in Michele Savonarola's *Libellus de aqua ardentis* (publ. 1484), one of the many examples of popular treatises on alcohol or 'burning water'.<sup>10</sup> Tommaso Garzoni's rather ambiguous report on the 'small brains of the alchemists' (*cervellazzi alchimistici*) in his *Teatro de' vari e diversi cervelli mondani* amply demonstrates how commonplace such ideas had become by the late sixteenth century. When Garzoni says that the alchemists, who invented distillation, were the inventors of 'l'acque vite' and of 'these essential spirits, these quintessences which, [...] as it were, resuscitate the dead',<sup>11</sup> he is echoing ideas that had long since become topical in very different fields of late medieval and early modern science, the arts and various literary genres.<sup>12</sup> And the opinion proved to be highly persistent; for example, in the *Historia vitae et mortis* (1623), Francis Bacon pronounces that, in order to wake people from cataleptic fits, or from fainting, one administers 'aquarum ex vino' because these substances are hot and go straight to the heart.<sup>13</sup> While the *ether* or the quintessence was

<sup>9</sup> On the medical use of a wide variety of different liquors in folk medicine see Eckstein, col. 1503–1507, with many references. See *ibidem* coll. 1499–1500 for the idea that the ghosts of the dead demand liquor as nourishment.

<sup>10</sup> Savonarola Michele, *I trattati in volgare. Della peste e dell'acqua ardente*: ed. Belloni L. (Milan: 1963) 46 'L'acqua de vita, de le medexine calide maestra e madre è chiamata, e dicta de la humana sanitade optima conservatrice e de le substantie restauratrice. E in seguitare de le sue laude, alcuni s'anno rescaldato, che non anno dubitato de dire, che per lo so uxo lo homo may infermare no se possere de infirmitade, de la qualle sanare non se possesse. Volendo anchora e dicono, a conservare, a prolungare la vita, comodità, adiutorio non puocho dare, sì che per lo so uxo la vita quasi perpetuare'.

<sup>11</sup> Garzoni Tommaso, *Il teatro de' vari e diversi cervelli umani*: ed. Cherchi P. (Ravenna: 1999) 222 (Discorso 49) [...] quelli spiriti essenziali, quelle quinte essenzie che [...] fanno quasi suscitare i morti.

<sup>12</sup> See, for instance, Savonarola, *I trattati* 47: [...] e dicto l'acqua de vita essere la quinta essentia, e a l'à ne le soe operatione e virtù semegliata e comparata al cielo.

<sup>13</sup> Bacon Francis, *Historia vitae et mortis*: in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874) 209 (§ 33) 'Ad resuscitandum eos qui deliquia aut cataleptēs subitas patiunt, [...] haec sunt in usu: Exhibitio aquarum ex vino distillatum (quas aquas vocamus calidas et cordiales)'.

important for alchemists and followers of Paracelsus, to a certain extent these ideas also formed part of Bacon's physiology. Combustible alcohol also obviously embodied the properties of fire, the most spiritual of all elements; it was precisely this fiery quality that it shared with *spiritus*, that finest and shining product of the human blood.<sup>14</sup>

The notion of medical spirits had been prominent from early Classical times well into the medicine of the seventeenth century. Therefore, the alcoholic liquors dropping out of the alembics soon became associated with medical theories; they also formed an integral part of alchemical procedures, both arts being closely related, since the *elixir* was also regarded as a substance that had the capacity to prolong life. Johannes de Rupescissa (ca. 1300–ca. 1365), seems to have been the first alchemist to identify *aqua ardens* with quintessence.<sup>15</sup> *Spiritus* is, of course, a much older medical concept, yet the distillation of alcohol increased its plausibility, so that the workings of *spiritus* gradually eclipsed the doctrine of the medical humours as an explanatory model for human physiology.

---

<sup>14</sup> For what is still perhaps the best account of the intricate concept of *spiritus*, see Walker D.-P., "The Astral Body in Renaissance Medicine", *Journal of the Warburg and Courtauld Institutes* 21 (1958) 120 'Medical spirits are very fine, hot vapour, deriving from the blood and breathed air. They are corporeal. They are usually divided into three kinds; natural, vital and animal [...]. The vital spirits are manufactured in the heart and conveyed by the arteries; their main function is to distribute innate or vital heat to all parts of the body. Animal spirits are elaborated from these and are contained in the ventricles of the brain, whence through the nervous system they are transmitted to sense-organs and muscles; their functions are motor-activity, sense-perception, and, usually, such lower psychological activities as the appetite, *sensus communis*, and imagination. They are the first, direct instrument of the soul'. See *ibidem* for a good account for the main weakness of the concept of *spiritus*, namely its 'paucity of empirical evidence'. On the identification of *spiritus/pneuma* with the alchemical quintessence, see Mothu A., "Le mythe de la distillation de l'âme au XVII<sup>e</sup> siècle en France", in Margolin J.-C. – Matton S. (eds.), *Alchimie et philosophie à la Renaissance* (Paris: 1993) 436–437.

<sup>15</sup> For instance, the anonymous *De quinta essentia libri II* (Strasbourg, Balthasar Beck: 1541) says that the elixir is extracted like alcohol from wine (6 recto) and that this spirit is akin to the human medical *spiritus* (5 verso); for characteristic illustrations, see, for instance, 13 verso and 14 recto. Cf. Pereira, "Medicina" 1–3 on the history of this concept, which dates back to a highly influential pseudo-Lullian treatise, the *Liber de secretis naturae seu de quinta essentia*, probably written during the first half of the fourteenth century. On the connections between alchemical distillation, quintessence, Stoic *pneuma* doctrines and Aristotelian *aether*, see: Pereira M., "Heavens on Earth: From the *Tabula Smaragdina* to the Alchemical Fifth Essence", *Early Science and Medicine* 5 (2000) 131–144. On Johannes de Rupescissa (ca. 1300–ca. 1365), DeVun L., *Prophecy, Alchemy, and the End of Time. John of Rupescissa in the Late Middle Ages* (New York: 2009) 70, and 105–109; Multhauf R.-P., "John of Rupescissa and the Origin of Medical Chemistry", *Isis* 45 (1954) 359–367 at 364–365; also Colnort-Bodet, "Eau-de vie logique" 75.

The technology of distillation provided material evidence for the theoretical underpinnings of a wide range of different arts. The process came to be seen as an explanatory foil for both the invisible mechanisms that govern not only the *machina mundi* and the physiological processes of the human organism. Our bodies are conceived as microcosms that are arranged in an order corresponding to the structure of the universe.<sup>16</sup> In the elliptical method of argumentation by analogy, characteristic for late medieval and early modern science, distillation therefore accounted for phenomena which were difficult or even impossible to observe, such as the digestion of food, or the interaction of body and soul.<sup>17</sup> This way of using a novel technological apparatus that produces spectacular results is, of course, not uncommon to other historical periods: more recently, physiologists have taken computers as their models for the explanation of cognition and its relationship to the human brain.

In the following I shall argue that distillation of alcohol – apparently a European invention – brought an alternative (or at least a crucial alteration) to the concoction paradigm which had served as Aristotle's explanation of physiological processes. In Aristotle's thought, the cooking of food provided a model accounting for physiological processes, such as digestion, in which transformations of matter occurred.<sup>18</sup> In this respect, the alembic was not only a more sophisticated (and more mysterious)

---

<sup>16</sup> Savonarola, *I trattati* 47 '[...] cossi l'acqua de vita in lo corpo humano, dicto mondo piccolo, le membre composte dritamente dispone, conserva, e le infomità chaçia, e induxe la sanitate, per lo so temperato uxo, e tira lo mondo piçolo a quei anni, ai quali ne creatione quello summo opifice ga donato secondo la soa complexione de podere pervenire'.

<sup>17</sup> For the Paracelsian idea that alchemy contributes to making invisible things visible, see Bianchi M.L., "The Visible and the Invisible: From Alchemy to Paracelsus", in Rattansi P. – Clericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 20.

<sup>18</sup> The ancient Greek theory of the four humours perceived women as moist and cold, and men as hot and dry. In fact, the dominance of form over matter was understood to be a physiological process analogous to 'concoction'. Aristotle used the term to describe the digestion of food in the bodies of both humans and animals. He maintained that, during this physiological process, heat successfully dominates the moisture of *materia*. Aristoteles, *Meteorologica* 4.2, 379b33–380a9 'Concoction ensues whenever the matter, the moisture, is mastered. For the matter is what is determined by the natural heat in the object, and as long as the *ratio* between them exists in it, a thing maintains its nature. Hence things like the liquid and solid *excreta* and waste-stuffs in general are signs of health, and concoction is said to have taken place in them; for they show that the proper heat has mastered the indeterminate matter. Things that undergo a process of concoction necessarily become thicker and hotter; for the action of heat is to make things more compact, thicker and drier. This is then the nature of concoction: but inconcoction is an unperfected state due to lack of proper heat, that is, to cold. That *of* which the imperfect state is, is the corresponding passive qualities which are the natural matter of anything'.



instrument than the boiling pot; the apparatus was also capable of producing a liquid with more spectacular properties than ordinary food. Booze seemed to affect the human soul directly: you can feel the alcohol rising to your head at much higher speed than, say, your lunch or even less potent alcoholic drinks, such as beer or wine. The new technology not only had the advantage of providing experiential evidence for the idea that the vital *spiritus* was a product of the finest parts of the blood: distillation could also be used as material evidence for the Aristotelian assumption that sperm contains *aether*, the celestial substance from which the sphere beyond the moon is composed. According to the Peripatetics, it is this quintessence that embodies the principle of movement and of life, which usually does not exist on earth, in the sublunary sphere; the notable exception being sperm, which contains *aether*, albeit in a strictly limited form.<sup>19</sup> The art of distillation, which allegedly is capable of producing such quintessences, therefore provides experiential evidence for the gradual erosion of the Peripatetic tenet according to which an insurmountable barrier separates the celestial and the terrestrial regions. According to this argument, heat was a crucial factor: except in concoction theory, where the substance in question became only thicker and hotter, the production of liquor seemingly proves that the distilled substance could exist in more refined and, hence, more effective states. The extracted essence would gradually become akin to the celestial quintessences which were believed to be endowed with life-giving, spermatic qualities. To corroborate this set of claims, the so-called *aqua ardens* texts devoted much energy to defending the (empirically true) observation that alcohol becomes stronger when the mysterious process of rarefaction is repeated several times.<sup>20</sup> Such ideas were not merely part of the lofty speculations of erudite scholars: the popular readership was obviously aware of these semantic

<sup>19</sup> Aristoteles, *De generatione animalium* 736b30–32; cf. also Nussbaum M.-C., *Aristotle's De motu animalium* (Princeton: 1978) 157–162. On sixteenth-century controversies over the celestial as opposed to an elemental nature of this *calidum innatum*, and by extension of *spiritus*, see Clericuzio A., "The Internal Laboratory: The Chemical Reinterpretation of Medical Spirits in England (1650–1680)", in Rattansi P. – Clericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 51–85, at 52, with nn. 7–9 for references. The female body is in no position to produce sperm, because it is not hot enough, says Aristotle (*GA* 728a); for a concise exposition of these ideas, see Siraisi N.G., *Medieval and Renaissance Medicine* (Chicago-London: 1990) 106.

<sup>20</sup> Cf. Savonarola, *I trattati* 62–63 'E io penso che per al multiplicade distillatione la dicta acqua molto più aprosimarse a la quinta essentia, perchè le multiplicade distillatione continuamente più se sottiglia, e abandona e lassa molto più la elementare natura, e chiussi in la soa complexione è più suave, imperò che più rara'.

concatenations. It is no coincidence that Michele Savonarola states that the true *aqua ardens* leaves the sweet smell of fresh human semen throughout a room in which a bottle of it has been opened.<sup>21</sup>

For many late medieval and early modern authors it was also not unreasonable to maintain that the more sophisticated water-cooled distillation apparatus resembled the *machina mundi* in its entirety. The still could thus not only be used as an explanatory foil for physiological processes in the human body: it also explained those macrocosmic structures of which human beings were believed to form an integral part.<sup>22</sup> The apparatus for the distillation of alcohol, therefore, opened up much wider scope for what human art could achieve beyond the traditional method of distillation. Yet the older model of the still had also been used as a model to explain some physiological phenomena. Avicenna had already compared the original form of the alembic – where the distilled liquids drip out of the beak – to running noses; in this case, the still served to explain why phlegm is emitted when we suffer from a cold. Avicenna was thus using the alembic to back up the traditional pathological concept of catarrh as the main cause of disease, with excessive vapours emitted by the stomach attacking the brain, and the noxious heat condensing to mucus and falling back ‘through the skull down to the nose, pharynx, lungs, joints, bones and another organs’ into the body.<sup>23</sup>

According to Avicenna, the nose is therefore associated with the beak of the still; much later, and in a distinctly Paracelsian environment, this

<sup>21</sup> Savonarola, *I trattati* 48 ‘[...] se poy, avertò el buxo de quello vasso, tuta la casa se impe de odore suave, a lo qualle odore niuno a quello equiperare e semigliare se possa, como è la dolceçia che in la emission del seme e sperma se sente, e sia questo odore suavissimo da ogno persona guidicato, sì chome da la sublime e alta gloria discendesse, non dubitare ch’è pervegnudo al la essentia quinta, a la qualle, como stimo, niuno medego de la etade nostra è pervegnudo’.

<sup>22</sup> On this topic, see also Bianchi, “The Visible and the Invisible” 22, who emphasises that the concept of the extraction of spirits was also applied to the cosmic drama of divine creation; the separation of the elements described in *Genesis* were to be understood as a form of alchemical distillation. On the universal spirit of the world which the Paracelsians tried to capture, see Clericuzio, “Internal laboratory” 54.

<sup>23</sup> Pagel W., *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance* (Basel-New York: 1958) 165. See Avicenna, *Opera* 1508 (*Canon medicinae* Book I.I.4,2; Book II.II,576; *De removendis nocumentis*, vol. IV.15). But see also Hippocrates, *De flatibus* 8 (6.100–104 L.). Della Porta Giambattista, *De distillationibus libri IX* (Strasbourg, L. Zetzner: 1609), book 1, chapter 1, 2 sums up these doctrines neatly: ‘Avicenna, qui sexcentis ab hinc annis vixit, de catharro loquens alembici, et distillationis meminit. Cum alimenti superfluitates in ventre non secernuntur, in vapores abeunt, qui in cerebrum impetu facto, caput replent, hos suo rigore in humorem vertit, qui per nares deflit, velit? in alembico, et alevo subjecto, in pileum vaporibus ascendentibus per vasis nares ad inferiora inferiora? fit defluxus’.

way of visualising physiological processes appears in a different context. In his *Aurora thesaurusque philosophorum Paracelsi* (Basel 1577), a text that was incorporated into Huser's edition of the works of Paracelsus, Gerhard Dorn shows an illustration of a special alembic in human form. It is designed as an instrument for what the author calls 'chemical uroscopy', that is, for analyses of urine by means of distillation; here again, what is supposed to be the nose in the human figurine has the distinct shape of the beak of a traditional alembic.<sup>24</sup>

Another traditional device that allowed for the continual distillation of one and the same substance (cohobation) was the so-called pelican: the upper and lower parts of this vessel are connected by three openings, a large central one, and two smaller tubes which run in semicircles to either side. The latter function as re-cooling devices for the vapours that accumulate in the upper part of the vessel; these smaller ducts allow for a continuous reflux of the distillate.<sup>25</sup> Probably because of its shape, which is vaguely reminiscent of the outlines of a human head and rump, with the arms pressed to the thighs, the pelican also served as an illustration of the ways in which microcosm and macrocosm are interrelated. Indeed, Heinrich Khunrath published a picture where the so-called *Rebis*, the androgynous microcosm in the centre of the universe, is shaped like a pelican, in which the elements are recycled on a continual basis.<sup>26</sup>

The idea that human art was capable of extracting the essences of things was, of course, pure nonsense for traditional Peripatetic philosophers. According to their physics, substantial forms cannot be perceived by the senses; substantial forms manifest themselves to us only indirectly by the change that constantly takes place in all sublunary bodies. Yet, by the later sixteenth century (and as early as the mid-thirteenth century among alchemists), the Aristotelian doctrine of hylemorphism had come under attack from various sides.<sup>27</sup> The art of distillation paved the way for

<sup>24</sup> For a reproduction of the illustration, as well as an instructive introduction to this form of uroscopy, see Pagel, *Paracelsus* 193 and 189–196; the illustration is also shown in Debuss, *Chemical Philosophy* 113.

<sup>25</sup> See Holmyard, *Alchemy* 50, for an illustration.

<sup>26</sup> Khunrath Heinrich, *Amphitheatrum Sapientiae Verae Christiano-Cabbalisticum* [...]. (Hanover, Antonius: 1609). Reproduction in Pagel W., *Das medizinische Weltbild des Paracelsus. Seine Zusammenhänge mit Neuplatonismus und Gnosis* (Wiesbaden: 1962) 140.

<sup>27</sup> On this topic, see Copenhaver B.-P., "Scholastic Philosophy and Renaissance Magic in the 'De vita' of Marsilio Ficino", *Renaissance Quarterly* 37 (1984) 523–584, and with special regard to alchemy and Avicenna, cf. the interesting discussion in Newman W., "Technology and Alchemical Debate in the Late Middle Ages", *Isis* 80 (1989) 423–445, 425–430, 435 and passim. Matton S., "L'influence de l'humanisme sur la tradition alchimique",

that characteristic shift in metaphysics and natural philosophy. Giambattista della Porta is a case in point. This Neapolitan polymath and 'doctor of secrets'<sup>28</sup> wrote that distillation is a means to make bodies spiritual, for he maintained that the process purified the material substratum of any substance.

Furthermore, what cunning [the magus] must have in the art of Distillation, which follows and resembles the showers and dew of Heaven, as the daughter the mother; I think no man will doubt of it; for it yields daily very strange inventions, and most witty devices, and shows how to find out many things profitable for the use of man. As for example, to draw out of things dewy vapours, unsavoury and gross scents or Spirits, clots, and gummy or filmy Humours; and that intimate Essence which lurks in the inmost bowels of things, to fetch it forth, and Sublimate it, that it may be of the greater strength. And this he must learn to do, not after a rude and homely manner, but with knowledge of the causes and reasons thereof.<sup>29</sup>

Della Porta also emphasises the importance and efficiency of distillation, because the process imitates 'celestial rain' (dew), the substance traditionally thought to transmit those astrological influences which govern the movements of terrestrial bodies.<sup>30</sup> The author implies that the alembic is the model for the macrocosmic condensation and rarefaction of all substances, a process that implies upward or downward movements in the universal hierarchy of being. The art of distillation here functions as experiential evidence for the assertion that all bodies move constantly between different states of aggregation, both of density and of refinement. In contrast to this, Aristotle had focused on the abrupt transformation of the elements and bodies in general, a process that – beneath the sphere of the moon and on a horizontal basis, so to speak – brought about life and death. The art of distillation thus purportedly provides sensual evidence for the assumption that the elements undergo a vertical process of

---

*Micrologus* 3 (1995) 297–306, describes the more ambivalent attitude of the humanists to the problem of substantial transmutation by human art.

<sup>28</sup> See Eamon W., *Science and the Secrets of Nature. Books of Secrets in Medieval and Early Modern Culture* (Princeton, N.J.: 1994).

<sup>29</sup> Porta Giambattista della, *Natural Magick* (London, T. Young – S. Speed: 1658) 3 (bk I, ch. 3).

<sup>30</sup> Porta Giambattista della, *Della magia naturale libri XX* (Naples, Carlino Vitale: 1611) 5 (bk I, ch. 3) 'Ognuno debba chiarissimamente sapere quanto giovi saper l'arte del distillare, imitatrice della celeste pioggia, e figlia, perche da quella son nati maravigliosi inventioni [...]'. On the idea that dew serves as a universal medium of communication in the universe, see Vergilius, *Georgica* 2.324–326; Cicero, *De natura deorum* 2.25 (65); Lucretius, *De rerum natura* (1.250ff.) 3.991–992.

condensation and rarefaction. The technique thus eclipses the idea that change in a substance comes about as an abrupt transformation: change rather becomes manifest as a gradual process. Thus distillation provides evidence for the claim that universal matter exists in many different degrees of refinement.<sup>31</sup> Obviously the art of alchemy, with its doctrine of the rarefaction of base elements into precious metals, and its goal, the extraction of the philosopher's stone, was heavily dependent on this complex of ideas.<sup>32</sup>

### *Ficino*

Marsilio Ficino (1433–1499), the most important fifteenth-century translator of Plato, Plotinus, and other Neoplatonist sources from late Antiquity, formulated his own highly influential system of Renaissance Neoplatonist metaphysics. His synthesis provided an important theoretical unity for a complex host of divergent ideas and made Ficino into an authority for alchemists, natural philosophers, Paracelsians and theologians.<sup>33</sup> Even though he was probably not a practising alchemist, Ficino knew Rupe-scissa, and seems to have been aware of the latter's ideas about quintessence and *aqua ardens*. Ficino also says that Arnaldo da Villanova and Ramon Llull [Raymond Lull] were able to separate this fiery vital spirit which is intrinsic to all things by means of 'certis machinis'. This is a vague expression conveying the sense of 'employment of a special apparatus', as

---

<sup>31</sup> Porta Giambattista della, *Della magia naturale libri XX* (Naples, Carlino Vitale: 1611) 430 (bk. X, *proemio*) 'Impara questa scienza cose mirabili, come i corpi, che son così gravi divenghino spirituali, e sottili, e montino in alto fatto leggeri, e così spirituali, che di nuovo diventino gravi, e corporenti, e calino giù. L'essentie, ovvero virtù delle cose, che stanno nascoste nella sua mole sotterrate, conculcate, e disperse, ne'suoi ripostigli, come nelle sue camerette, ma pure, e sottigli quasi senza meschiamento di materia impura, così nelle piante, come ne' metalli, pietre, e gemme, e noi non contenti di quelle manifeste virtù, che possedono, le vogliamo più nobili, e più gagliarde, e far le più sollimi, e quasi inalzarle infin al cielo'.

<sup>32</sup> On this kind of 'medicina subtilitativa' in the alchemical medicine of Arnaldo da Villanova's *Speculum medicinae*, see Calvet A., "Mutations de l'alchimie médicale au XV<sup>e</sup> siècle: A propos des textes authentiques et apocryphes d'Arnaud der Villeneuve", *Micrologus* 3 (1995) 194–195. In alchemy the term 'vinum nostrum', increasingly refers to the quintessence of metals (*spiritus in lapidibus*) and especially to mercury, rather than to *branntwein*; see Matton S., "Marsile Ficin et l'alchimie, sa position, son influence", in Margolin J.-C. – Matton S. (eds.), *Alchimie et philosophie à la Renaissance* (Paris: 1993) 170–172.

<sup>33</sup> On this topic, see Matton, "Marsile Ficin et l'alchimie" 123–125 and *passim*, who shows that Ficino was well aware of the alchemical tradition.

well as 'a certain procedure or scheme'.<sup>34</sup> His writings suggest that Ficino had a rather superficial experience of the actual business of distillation.<sup>35</sup> Yet (perhaps because of this) he made the theoretical alchemical underpinnings of this art fit into his Neoplatonist metaphysical synthesis. In an important move, Ficino identified the *spiritus mundi*, the vehicle of the world-soul, with the quintessence of the alchemists.<sup>36</sup> In this way, the art of distillation acquired a genuinely cosmic importance, for it mirrored the workings of the heavens, and at the same time accounted for the change of all things in the sublunary sphere. The author's commentary on Plotinus gives us a good impression of how Ficino wished the transmutation of the elements to be understood: they are to be seen as phenomena relating to condensation and rarefaction rather than to a genuine and abrupt transformation.

And as air is something of its own before it is poured into earth, so earth is something on its own, before it swallows air. And as air existed before in its own refined state, before it is condensed into earth, and earth existed before on its own, before it condenses air, which, when it is condensed by water, it transforms into water.<sup>37</sup>

According to this passage, the composition of an actual object is therefore determined by its more or less refined state rather than by its intrinsic and tactile qualities, as in Aristotelian physics. In a similar vein, Ficino says in the *Theologia Platonica* that one single matter hides under various shapes or forms, and that this matter dresses itself in diverse garments, which are determined by states of density or rarefaction: the finer a body, the

---

<sup>34</sup> Ficino Marsilio, *In Plotinum, Opera omnia* 1603, see Matton, "Marsile Ficin et l'alchimie" 149–151 for a presentation of the entire passage in context.

<sup>35</sup> One of Ficino's later critics, Nicolas Guibert, perhaps went too far when in 1603 he scathingly remarked that Ficino had been ignorant of chemistry to such an extent that he would hardly have been able to distil even rose water. See Matton, "Marsile Ficin et l'alchimie" 192.

<sup>36</sup> See Matton, "Marsile Ficin et l'alchimie" 145 and 166–168, and *passim*; Matton, "L'influence de l'humanisme" 344–345 shows that Ficino's idea was plagiarised by Agrippa of Nettesheim and thus also became very influential in the tradition of sixteenth-century natural magic and alchemy.

<sup>37</sup> Ficino Marsilio, *In Plotinum, Opera omnia* 1600 (*Ad Enn.*, II, 1, 6) 'Rursus aer prius in se aliquid est, quam infundatur in terram, terra similiter prius aliquid in se est, quam hauriat aerem. Tum vero aer in raritate propria prius existit, quam condensetur in terram, ac terra prius in se consistit, quam condenset aerem, qui si condensetur ab alio, scilicet aqua, transibit in aquam'. On this passage, see also Matton, "Marsile Ficin et l'alchimie" 136–138.

more elevated its position in the hierarchy of being.<sup>38</sup> Just as clear and powerful liquor condenses in the alembic, distilled from must, grain or even sawdust, Ficino's approach emphasises that matter may pass from a crude state to a highly refined entity (and vice versa). Ficino thus aims at a simplification of traditional physics in order to bring it into accordance with Platonic metaphysics.<sup>39</sup> This simplification is an important aspect of in Ficino's cosmology, for here it is varying degrees of refinement that mark the differences between celestial and terrestrial elements. Accordingly, Ficino maintains in his *De vita* that bodies 'coalesce' only at certain times and in specific places.<sup>40</sup> What is decisive for the quality of a body is, therefore, the specific position it occupies in the hierarchy of being at any given moment in time, as opposed to its intrinsic and immutable qualities. Ficino employs two concepts to illustrate this scheme of elemental interaction in the universe: he transfers the Platonic dialectics of light and darkness on to matter and form, and he backs up this idea with the results generated through the art of distillation. According to Ficino, this art provides evidence for the phenomena of condensation and rarefaction of one and the same substance, universal prime matter.

As such, the experiences of Rupescissa and others with the technique of distillation of alcohol form the conceptual backdrop to Ficino's version of Neoplatonic natural philosophy; emphasis on the phenomena of condensation and rarefaction led to a perception of physical bodies that emphasised *quantitative* approaches (e.g. degrees of refinement) rather than the traditional *qualitative* descriptors (e.g. hot, cold, moist, dry).<sup>41</sup> The elements could now be viewed as representations of universal intellectual forms which spread throughout the entire creation; they are thus more akin to potentially stable, non-contradictory metaphysical entities which may move up or down the metaphysical scale of being, and cease to be the unstable compounds of qualities that cause the erratic movement of sublunary bodies in

<sup>38</sup> Ficino Marsilio, *Théologie platonicienne de l'immortalité des âmes*: ed./tr. Marcel R. (Paris 1964–1970), vol. I, 178 (V, 4) 'Itaque materia quae prius sub aquae frigore latuerat, iam sub aeris calore eadem dilettescit [...]. Vides materiam unam omnes vicissim indui formas, dum et ascendit rarefactione et densitate descendit'.

<sup>39</sup> Ficino's discreet modifications bear on the core of Aristotle's natural philosophy, since he seems to be aiming to reduce the ten categories to two, namely quantity and quality.

<sup>40</sup> Ficino, *De vita libri tres* 302 (Book III, 12) 'Sicut ergo certa passim corpora eorumque formae certis et locis et temporibus coalescunt, atque servantur, sic, et proprie quaedam actiones ex propriis quibusdam temporibus efficaciam nanciscuntur'.

<sup>41</sup> On this issue and with regard to alchemy in general, see the interesting discussion in Colnort-Bodet, "Eau-de vie logique" 310–311.



Aristotelian physics. This analogy between the distillation of alcohol and the medical spirits is pushed even further: according to Ficino, the human brain contains a mixture of *spiritus* that is a temperate mixture of fire and water – in short, *aqua ardens*. In this form, it has the best physical conditions for the act of sensation.<sup>42</sup> Likewise, Ficino holds that the human heart functions as an alembic where the more refined blood condenses.<sup>43</sup>

Thus, the art of distillation and the theory of medical spirits back up a circular argument: because of its fiery nature and its capacity to affect mind and body, the extracted liquor proved to be a potent 'spiritual' substance, so distillation confirmed the existence and the workings of medical spirits in the human body. The technology in its turn was ennobled because it became endowed with an explicit cosmological significance. Importantly, this idea was not only applied to physical bodies. The different states of matter are paralleled in a moral hierarchy that forms the most important part of Ficino's metaphysics. Ficino assumes that, in the process of purifying their souls, human beings also have the power to refine their bodies. The technology of distillation is thus used to support an argument for the original Platonic idea, so dear to Renaissance Platonists, namely that the human soul may purify its essence and activate its daemonic, divine potential, thus realising an ascent of the individual soul to the godhead.

Yet, as we have seen above, Ficino's ideas were also transformed by medical practitioners and in different directions. The idea of the refinement of medical substances by means of distillation was common to Paracelsians of all kinds, as well as to natural philosophers who were interested in materialistic, but non-mechanist, explanations of the workings of nature.<sup>44</sup> In the next section, I shall discuss one author who worked around the

---

<sup>42</sup> Ficino Marsilio, *In Theophrastum, Opera omnia* 1821 (ch. 44) 'Spiritus est vapor quidam sanguinis, sic ipse ex quatuor componitur elementis, quamquam longe subtilioribus. Spiritus in corde vitalis evidenter est igneus ex perpetuo cordis motu, efficacique, et ita talis apparens, spiritus naturalis in iecore plurimum est aerius ita concoctioni generationique prorsus accomodatus, spiritus animalis in cerebro igne et aqua est quasi pariter temperatus sensib[ilia] sic expositus, [...] temperies illa quidem ex aere, atque aqua ad omnes scilicet sensus accomodatissima est. Non tamen ubicunque est ibidem sensus omnes existunt, nisi et in hanc temperie sint formales omnes proprietates ad omnia sentiendo, et in corpore sunt omnia sensuum instrumento'. Cf. also Ficino, *Appendix in Timaeum*, ch. 71; in *Opera omnia* 1478; and *ibidem* ch. 80, 1479.

<sup>43</sup> Ficino, *De vita libri tres* 223–225 (II, 18).

<sup>44</sup> On the development of this topic later in the seventeenth century, and 'psycho-pyrist's' such as Francesco Maria Pompeo Colonna (1644–1726), see Mothu, "Le mythe de la distillation" 440–443, 447 and *passim* with many references.

turn of the sixteenth century, in whose texts the alembic serves as a model or blueprint for physiological processes in the human body.

*Joseph Duchesne*

Duchesne, a French Calvinist who, after 1593, acted as physician to Henry IV, 'became a key figure in the Paracelsian-Galenist debate at Paris in the first decade of the seventeenth century' with his *De vera medicina* (1603).<sup>45</sup> Even though his ideas were clearly Paracelsian, he did not consider himself to be an unconditional adept of the teachings of the master from Hohenheim. Rather than agreeing with his master on all points, he '[...] argued that the true chemical physician should appreciate the work of Hippocrates and Galen while at the same time recognising that much had been discovered since their time'.<sup>46</sup>

In spite of his ostensibly conciliatory attitude towards divergent medical doctrines, Duchesne's own approach involved deep changes in the traditional system of natural philosophy. In accordance with the doctrine of the three Paracelsian elements, the author introduces a system of three rather than four humours, out of which he postulates that the elements are secondary forms of matter, being the product of 'chymical' principles. Duchesne accordingly redistributes the traditional elemental structure in the following way: salt (earth/chyle), sulphur (fire/blood) and mercury (water and air/*spiritus*).<sup>47</sup> This arrangement is not only reminiscent of Ficino's Renaissance Neoplatonic account of the elements; it also has the advantage of giving prominence to the phenomena of condensation and rarefaction of vapours or spirits. This idea plays a key role in Duchesne's account of the distillation of spirits as well as in his outline of human physiology, because here again the 'perfection of concoction' has a vital function: it allows the observer to discriminate between matter in its different states of refinement, and hence to distinguish between different states of perfection. Equipped with this knowledge, we are now in a

---

<sup>45</sup> Debus, *Chemical Philosophy* 148–149, on the author in general; on the Paris confrontation, *ibidem* 159–173. For a recent and very detailed study of Duchesne, see Kahn D., *Alchimie et Paracelsisme en France (1567–1625)* (Geneva: 2007) 233–251, on the *De priscorum philosophorum* and the debates this work stirred, *ibidem* 363–373.

<sup>46</sup> Debus, *Chemical Philosophy* 150. For Duchesne's doctrine of *palingenesis*, see *ibidem* 102–103.

<sup>47</sup> Cf. Debus, *Chemical Philosophy* 104 and 162–165. On the three elements in Paracelsian medicine, see also Bianchi, "The Visible and the Invisible" 22.

position to examine the following lengthy extract from Duchesne's *De vera medicina*:

From the refinement of wine we get to know the anatomy of our vital blood: and from the same it becomes to be known what our inborn spirits are: ethereal, the same as our inborn heat, and as our radical heat. These two bodies support our body, and protect our lives, and one is necessarily dependent on the other: for this radical heat is the fuel and wick of the heat, and this very heat persists with the help of this moisture. Therefore these two spirits are ubiquitous, and as it were, joined together, and are infused into all bodies. From the same example the difference between the vital, nourishing and the useless, excremental humidity comes to be known [...]. For when wine is made, the press first presses the bunches of grapes: and the skins and the grapes are divided [from the juice], and cast away. Then the useless dirt and the superfluities are repelled: partly by human industry, partly by the wine's own nature. The wine is filled into casks and barrels. In these, the digestion is brought about, and at the same time during the fermentation [the wine] with its own power also separates and ejects the impurities and coarser superfluities. After this the wine is almost ready to be used as drink and as nourishment. This first artificial preparation of wine (which consists in the separation and the pressing of the nourishing substances) shows us in a certain way the preparation of the grain in which the wheat is separated from the chaff, and the remaining is milled into flour, in order to be more apt as a nourishment. And this is the first separation of the meat from the bones in our mouth, and so forth. The pressing therefore happens in the mouth with the teeth: then, the right way of chewing sinks the food into the belly. And this is our first preparation of the nourishment that is analogous to the first [preparation of] wine and grain: what is entrusted to the stomach, corresponds to that wine which is poured into the casks, as well as to already-threshed flour. The following operation in the stomach is of a different nature: for that which the stomach contains, it digests, that is, all kinds of food that are mixed together, just as the wine matures in its cask (or any other kind of drink, be it from honey, fruits, barley, or water containing various infusions). The stomach is therefore some sort of natural cask; here [in the stomach] the matter which it has been entrusted with is not so much cooked or digested, here rather the tartareous faeces – and whatever excrement contained [in that matter] – is separated by means of conduits which are naturally designed for this; and finally, after many purifications, the blood becomes clear, the red source and the origin of our vital spirit [...]. From this wine and by means of *vasa circulatoria* as they call [the alembic], the fire of nature is extracted, which is accompanied by radical moisture: in short *aquavit*, that is fiery and ethereal, and really quintessence, and entirely spiritual and of a really incorruptible nature. In a similar way the effects of the natural fire are generated in us by the circular course of the heat in the heart and in the liver. This life-giving fire is pressed together and kept warm by its own oily humour: and it is [generated] by the radical [heat] which is *aquavit*, and [it is] in truth and in similitude this life-

giving nectar or quintessence, and generally by this ethereal *spiritus*, [may be called] the incorruptible protector and defender of our lives. And this happens in the process of the aforementioned activity of wine, and it is truly worth mentioning and admirable, that only two or three pieces of glowing charcoal placed under a very large vessel – which is called the *cacabo* (and contains twenty or more *hemias* of wine) – heat this wine and elevate the spirit of the wine so that it becomes distilled. This [happens] in spite of the fact that from such an exiguous [quantity of] heat only a much smaller quantity of water can hardly be made lukewarm. But what is admirable and notable, is that while this wine-spirit passes through the *colurina* – as they call them, that is trough oblong metal channels or pipes and retorts which are suitable for this [kind of] distillation – it heats them to such an extent that one can hardly touch [these pipes] with the hand; even though [the pipes] run through a huge cask which is full of cold water and [even though it is positioned] at an adequately removed [distance] from the fire. And this is certainly to be attributed to the enormous heat which the wine-spirit – by means of the aforementioned pipes – communicates to the cold water [in the cask]. The [heat of the] wine spirit is thereby not totally extinguished, [...] and you can perceive that its heat is only slowly being extinguished and cooled in the cask. And this we have to keep in our minds, [...] that this heat is certainly aroused in us from the incessant and perpetual circulation of the life-giving spirit of our blood.<sup>48</sup>

In this quotation, which is reminiscent of a key passage in the *Labyrinthus* of Paracelsus,<sup>49</sup> Duchesne develops in great detail the analogy between different metabolisms inside the human body and the art of distillation: the mouth is analogous to the winepress, the stomach to the barrel where the fermentation takes place; the remaining digestive organs produce a kind of ferment that is finally capable of bringing forth the ethereal *spiritus*, the essence of life. The author seems to have had some hands-on experience of the process of the distillation of spirits. This becomes apparent in Duchesne's detailed description of the cooling device as well as in his observation that much less energy is needed to bring alcohol to the boil than for water. Even though the text probably exaggerates this difference, it is based on genuine observation; the author also rightly acknowledges the indispensable function of the cooling device in the distillation process. He further points out that the intrinsic heat of the distilled vapours – their *calor* – certainly could not have been received from the heat of a few

<sup>48</sup> Duchesne Joseph, *Liber de priscorum philosophorum verae medicinae materia* (Paris, Eustatius Vingon: 1603) 121–124 (My translation).

<sup>49</sup> Cf. Hannaway, *The Chemists* 44–45, for a translation of and a comment on the relevant passage.

pieces of charcoal that heat the alembic alone. This idea enables him to postulate the affinity, if not the shared identity, between distilled alcohol and the *spiritus vitalis*. The still here is not merely being used as evidence for the actual existence of the vital spirit in the human body. The special heating qualities of the wine spirit are also conducive to a materialistic explanation of physiological processes in general. Duchesne believes that the genuine extraction of *aquavit* represents the three hypostatic principles of Paracelsian medicine in their full purity: mercurial liquor, sulphuric flame, and the spirit of ammoniac salt. As a residue, a large quantity of phlegm remains in the body, which itself originates from the mercurial liquid.<sup>50</sup> The author therefore observes that the metabolic distillation process leaves yet further waste in our bodies. The lowest remnants of this organic distillation are of a 'tartareous nature', that is, they consist of 'sulphuric nitre', a substance that contains many impurities and a great deal of salt. Duchesne identifies these unclean substances with the stuff that our eyes and our noses expel and he maintains that these bodily fluids correspond to the waste that occurs in the process of the distillation of wine-spirit.<sup>51</sup>

As a faithful Paracelsian, Duchesne goes on to explain that these fetid residues cause dangerous blockages, and are the (smelly) origins of many diseases in the higher as well as the lower parts of our bodies. Here, they

<sup>50</sup> On mercury and its distillation as the cause of sudden death according to Duchesne, see Bianchi, "The Visible and the Invisible" 23.

<sup>51</sup> Duchesne, *Priscorum philosophorum liber* 124–125 'Post extractionem verae ac genuinae aquae vitae, seu spiritus vini (qui est in tota illa puritas) trium principiorum hypostaticorum cuius liquor mercurium, flamma (quam prompte concipit) naturam sulphuream, acumen vero, et vis eximiae gustum feriens, spiritum salis armoniaci repraesentant: magna restat copia phlegmatis, seu liquoris mercurialis, qui continet quidem aliquid adhuc spiritus vini. At quod reliquum est, nihil est aliud quam aqua inutilis, quae mox vapescat atque corrumpatur simili quoque ratione potest extractionem aquae vitae, ac vere spiritualis ex sanguine nostro residuus manet in corpore humidus, et humectans ille liquor, quem partim alimentosum, partim excrementosum diximus. Restant ultimo, praeter praedicta, foeces, seu residentiae tartareae, et nitro sulphureae, quae in se multas foetidas [125] impuritates, ut et magnum salis copiam continent. Impuritates oculis, et tetri foetores naribus satis superque se produnt, dum diversa ex his olea vehementi igne extillantur. At ex foecibus calcinatis sal elicitur, idemque fixum cum proprio phlegmata, ut supra docuimus in operatione eiusdem vegetabilis [...]. Similiter et in sanguine praeter spiritum illum vitae, et liquorem mercurialem (quae duo re vera separari ab ipso sanguine, et ad oculum ostendi, post digestionem convenientes, in calore Bal[nei] Mar[iae] qui fit analogus calori naturae, ut melius et facilius constet, quomodo idem calor eademque natura in nobis eadem faciat operationes et separationes) praeter illa duo, inquam, quaedam consistentia mollis liquidi instar residebit in fundo, in qua mellita consistentia multas impuritates invenies, quas oculis et naribus percipies, si ad ignem cinerum febrili analogum materia praedicta exsicceatur'.

happen to appear like the meteorites of the macrocosm.<sup>52</sup> Later in his book, Duchesne names a few of the diseases (among them, arthritis and *calculus*, the stone) which are caused by the obstructions through *tartarum*, the very same substance which remains in the alembic after the process of distillation is completed. Again, it is the art of producing wine-spirit that serves as the material basis for the theory of these obstructions in the body, which Duchesne calls *meteora*.<sup>53</sup> He frequently compares these stones to tar, in other words, to the unwanted by-products that come into existence during the distillation of vital *spiritus* in the human body.<sup>54</sup>

For scholars who are acquainted with Paracelsian medicine this detailed account of distillation of grape-wine should not sound unfamiliar. First and foremost, it is the explanation of what Paracelsus himself had termed 'tartaric diseases', that is, of infirmities that are caused by the obstruction of the tubular systems, such as the bronchial tree when it 'is obstructed by inspissated and often calcifying material, for instance lung stones, known to us as the product of tuberculosis infection'. Moreover, Paracelsus had already emphasised the function of the stomach as the 'alchemist within' in the process of digestion, because it separates the poison contained in the food by sublimation.<sup>55</sup> This job is done by the remaining digestive organs, such as the liver, the kidneys, the bladder and the guts. What cannot be incorporated into the body during this metabolic process will remain undigested, because this matter remains 'what it has always been' – tartar – 'an agent from outside rather than a product of the humours'.<sup>56</sup>

---

<sup>52</sup> Duchesne, *Priscorum philosophorum liber* 125–126 'Quippe qui [...] nitrosulphureus ille foetor manifeste in nobis causat meteora ignita tam superiori, quam inferiori corporis parte, aliaque innumera symptomata parit, ut ostensum est supra. Sic ignis quoque vi, (haud secus, ac ex vini) ita ex foecibus, et tartaro sanguinis, separari possunt sulphura atque olea picis in modum crassa atque tenacia: adhaec tanto foetore abominanda, ut ne praesens [126] quidem prae abominando illo odore subsistere queas: ex quibus multa symptomata in corpore nostro suboriri posse quilibet facile colligere postest'.

<sup>53</sup> For the analogy between the tartaric stones in our body and their macrocosmic counterparts, the *meteora* (meteorites), as well as their connections to thunderstorms in Paracelsus, see Pagel, *Paracelsus* 155.

<sup>54</sup> Duchesne, *Priscorum philosophorum liber* 240 'Sed et in sanguine nostro, tamque purissimo, simili prorsus modo et ratione, ut de vino diximus; quemadmodum ars destillatoria (etiamque ea quae per temperatissimum ignem fit) ostendit ac patefacit eusmodi tartarum. Si quoque Natura igne suo naturali efficere potest, et in dies efficit eusmodi separationes tartari, etiam per consumptionem partium humoralium corporis nostri: [...] Ex qua separatione mirum quot morborum genera, obstructionum, seu oppilationum interventu procreantur'.

<sup>55</sup> Christie J.-R.-R., 'The Paracelsian Body', in Grell O.P. (ed.), *Paracelsus. The Man and his Reputation, his Ideas and their Transformation* (Leiden-Cologne: 1998) 282, with many references.

<sup>56</sup> Pagel, *Paracelsus* 153 and n. 78 for references in Paracelsus.

The substance is produced by the activity of salt, and it coagulates mucoid matter. For Paracelsus, these tartaric diseases are 'the general principle of medicine', as they cause 'disease by faulty digestion resulting in local as against humoral changes'.<sup>57</sup>

Duchesne's materialistic account of the production of vital *spiritus* in the human body has the advantage of allowing for local explanations of disease and, by extension, for the establishment of a concept of health in which the tubes in the body remain free for the circulation of *spiritus*, just like the tubes in the cooling device of a water-cooled alembic. The author's link between the distillation of 'branntwein', and tartaric diseases can be attributed to Paracelsus, who says in his *Opus paramirum* that these acrid residues in our organs often remain invisible because of their volatility, and that they go 'into these organs like a spirit that ascends and descends and appears to be devoid of body. It is there, however, and even if it is placed in a still (pelican) and circulates [is distilled] it has its tartar in itself'.<sup>58</sup> Viewed in this way, disease 'becomes a metabolic disorder, a failure to separate pure from impure nourishment'.<sup>59</sup>

Duchesne concludes his exposition of the affinities between *aquavit* and the *spiritus vitalis* with the remark that his account is the 'true anatomy of the blood, which is not given blindly, but from a manifest demonstration, and, as it were, in an irrefutable autopsy we have given ocular proof that the blood has a great analogy to the wine'.<sup>60</sup> This remark again alerts us to what was probably the most basic shortcoming of the *spiritus* theory: the existence of the miraculous substance had always been difficult to prove. The Paracelsians – with their distinct orientation towards spagyric explanation – were willing to give their accounts of the workings of the human body all the evidence they could get from their work at the furnace. Their theory, which connected microcosm and macrocosm with a doctrine of three chemical substances, was conducive to what was perhaps the most explicit and detailed exposition of the distillation-analogy in human

<sup>57</sup> Pagel, *Paracelsus* 154.

<sup>58</sup> Paracelsus, *Opus paramirum*, lib. III, tract. 4. ed. Huser, vol. I, 59 quoted after Pagel, *Paracelsus* 155. On the macrocosmic analogy to these stones, the meteorites and the causes of thunderbolts, see *ibidem*.

<sup>59</sup> Pagel, *Paracelsus* 155.

<sup>60</sup> Duchesne, *Priscorum philosophorum liber* 126 'Atque haec est vera atque vitalis anatomia sanguinis, quem non temere, sed vere, et manifesta demonstratione, et quasi ad oculum ipsaque data autopsy innitenti ostendimus magnam habere cum vino analogiam'.



physiology.<sup>61</sup> Duchesne accordingly says that the true philosopher knows that both liquids – mercurial ones and wine-spirits – are nearly *spiritus vitae*. Moreover, he knows that their effects and by-products are a mixed blessing: for even the wine we drink contains a number of potentially toxic residues, and the casks in which it was produced are full of tartar. We therefore have to acknowledge that the products of the spirit of life in our own bodies produce many such harmful residues.<sup>62</sup>

### Francis Bacon

Francis Bacon was an author highly aware of the long tradition of *spiritus* theorists: by maintaining that *all* tangible things contain an imperceptible, albeit material substance, Bacon adapts Ficino's idea that the quintessence is the *spiritus* of the world-soul.<sup>63</sup> Spirit, in Bacon's words, is 'a mysterious combination of a flameous and an aerial nature'.<sup>64</sup> It is, I would therefore conclude, akin to the no less mysterious properties the medieval alchemists detected in *aquavit*. Central to Bacon's characteristic adaption of alchemical ideas<sup>65</sup> is the concept that spirit is somehow imprisoned in a substance, and that – like the human souls of the Neoplatonists – the spirit wants to flee the material body by which it is held captive. *Spiritus* seeks to escape either under its own steam (to use a literal metaphor), or by exiting the body through a gradual assimilation of some of the coarse matter it finds in its prison. When the object is eaten up, and left in a

<sup>61</sup> On this topic in Paracelsianism in general, see Christie, "The Paracelsian Body" 278, McKee F., "The Paracelsian Kitchen", in Grell, O.P. (ed.), *Paracelsus. The Man and his Reputation, his Ideas and their Transformation* (Leiden-Cologne: 1998) 294–295 with many references.

<sup>62</sup> Duchesne, *Priscorum philosophorum liber* 126 '[...] cum verus philosophus aequae ex uno, atque ex alio (licet alterum maius artificium requirat) norit sapere aquas vitae penitus spirituales, quae impetentia dicuntur; praeterea liquores mercuriales tam utiles, quam noxios, quae humectantia: denique halitus et fuliginosae exhalationes, quae efflentia appellantur. Quod si igitur in vino, quo in dies utimur ad nutritionem corporis, eoque puro et claro post separationem spiritus eius, videamus tot res heterogeneas, tamque impuras; quanto quaeso, plure, solidioresque deprehendimus in tartaro vinorum doliis atque cadis adhaerescens, atque ex foecibus et residentia vini eiusdem?'

<sup>63</sup> For a brief outline of Bacon's *spiritus* theory, see Rees G., "Matter Theory: A Unifying Factor in Bacon's Natural Philosophy?" *Ambix* 24 (1977) 111–113.

<sup>64</sup> Bacon, *Historia vitae* 223–224.

<sup>65</sup> On which see the classic study by Rossi P., *Francis Bacon. From Magic to Science* (London: 1968) 13–17, 20–22.

state where it is shrunk, spitted and corrugated,<sup>66</sup> the *spiritus* is able to leave its cell; it may then mingle with its cognate element, air, and enjoy the rays of sunlight. Bacon distinguishes these kinds of *spiritus* from the 'living spirits' which inhabit inanimate objects. The latter dwell in and are capable of developing plants, animals and human beings, into amazingly complex structures.<sup>67</sup> In order to keep these spirits in the body and thus to prolong one's life, one has to slow down the movement of the spirits, for the animal *spiritus*, locked inside the organic body, is responsible for shaping it. In order to prevent decay, we therefore have to take good care not to arouse the spirit to such violent motions that it breaks and leaves its cells. The cooling and soothing of the *spiritus* inside its vessel is therefore the necessary prerequisite for a long life and the proper functioning of all human physiological processes.<sup>68</sup>

From this brief outline, it is apparent just how much Bacon's account of *spiritus* is modelled on his experiences with the distillation of alcohol. Again, as in Ficino and in Duchesne, it is the evidence generated by the still that serves as a guideline for understanding not only human physiology, but the very workings of the universe in general. Just as the must in the distillation apparatus has to be heated carefully for the wine spirit to evaporate slowly, so the animal spirits have to be kept from leaving the body prematurely. The close relationship between distillation of spirits and Bacon's ideas about human physiology also becomes obvious in an experiment described in his *Novum Organum*.<sup>69</sup> In order to find out in which quantitative relationship the imperceptible *spiritus* stands to its tangible body, Bacon constructs a device that is in fact a further development on the distillation apparatus. Taking a small phial filled almost to the brim with one ounce of wine-spirit (*spiritus vini*) – for this is the 'rarest and contains least matter per unit volume'<sup>70</sup> – he weighs the container together with the liquid. Bacon then tightly seals the vessel with a bladder that is capable of holding two pints, having previously squeezed out of the

<sup>66</sup> Bacon Francis, *The Instauration Magna Part II: Novum Organum and Associated Texts*: eds./trs. (etc.) Rees G. – Wakely M. (Oxford: 2004) 348 (ch. 40).

<sup>67</sup> Cf. Wallace K.R., *Francis Bacon on the Nature of Man* (Urbana-Chicago-London: 1967) 22–39 and *Novum Organum*, 348–350 (ch. 40), where Bacon writes that the prerequisites for the development of an organic body are gentle heat (*lenitas caloris*) and the viscosity of the body (*lentor corporis*).

<sup>68</sup> Bacon, *Historia vitae* 269.

<sup>69</sup> For a highly readable and interesting analysis of the passage from the *Novum Organum*, ch. 40, 352–54, from the perspective of the theory of rhetoric, see Briggs J.C., *Francis Bacon and the Rhetoric of Nature* (Cambridge, Mass.-London: 1989) 147–148.

<sup>70</sup> Tr. Rees, in Bacon, *Novum Organum* 353.

bladder all the remaining air. The apparatus is then gently heated until what Bacon calls the 'Vapour or Aura of the wine-spirit' becomes 'pneumatic' and completely inflates the bladder. The apparatus is removed from the fire, and, in order to prevent the pneumatic *spiritus* from re-condensing into the phial, Bacon pierces a tiny hole into the top of the balloon: he then compares the loss in weight of the remaining wine-spirit and concludes that the pneumatic body is more than a hundred times the size of the material one.<sup>71</sup> It is important to note that the corollary of this experiment consists in the assumption that heating a body brings about what Bacon calls a 'mutatio et versatio', a conversion and a kind of change to the object.<sup>72</sup> Bacon's pneumatic matter theory,<sup>73</sup> together with his experimental device, generated quantitative evidence for the existence of *spiritus*.

In the texts I shall now consider, the *Historia vitae et mortis* (published in 1623) and the *Sylva sylvarum* (1627), Bacon is not directly embracing the distillation-*spiritus* analogy; even so, the still for the production of alcohol serves for him as the tacit background for his theories on human physiology. In the *Historia vitae et mortis* Bacon unites a wide array of different theories about the subject of longevity under his general explanatory model that death is caused by the exhaustion of the animal spirits; consequently, this process has to be slowed down or retarded by cooling the human body. Bacon's definition of the *spiritus vitalis* is reminiscent of alcohol, when he says that 'the *spiritus* is a tenuous body, [...] however, it has a definite place, is extended and real; yet this *spiritus* is not air (just as the juice of grapes is not water), but rather a tenuous body which is akin to air, and yet very much different from it'.<sup>74</sup> In human beings, this vital spirit resides for the most part in the ventricles of the brain, that is the highest part of the body, and it is inflammable. It has a fiery nature, which, according to Bacon is due to what he calls the 'aura' (which probably in this case means the 'vapour') of the *spiritus* that is composed of

<sup>71</sup> Bacon also toyed with the idea that his model of *spiritus* could not only account for the bodily formation of the individual, but also for intellectual processes of all kinds. On this see Deleule D., "Francis Bacon alchimiste de l'esprit humain", *Les études philosophiques* 3 (1985) 297–298, and Gemelli B., *Aspetti dell'atomismo nella filosofia di Francis Bacon e nel seicento* (Florence: 1996) 106–139, esp. 125–128.

<sup>72</sup> Bacon, *Novum Organum* 354 *Corpus istud ita versum et mutatum*.

<sup>73</sup> Rees, "Matter Theory" 118.

<sup>74</sup> Bacon, *Historia vitae* 213 '(Explicatio) Spiritus [...] est [...] corpus tenue, invisibile; attamen locatum, dimensum, reale: neque spiritus ille aer est (quemdamodum nec succus uvae est aqua); sed corpus tenue, cognatum aeris, at multum ab eo diversum'.

flame and air. It is gentler than the weakest flame of the spirit of wine and other substances; and it is for the most part mixed with an airy substance, which makes the *spiritus vitalis* a mystery of the natures of flame and air.<sup>75</sup> This statement points to the extent to which the technological model of *aqua ardens* provided Bacon with evidence for the existence of spirits. Even though he maintains that the vital spirit is an exceptional natural phenomenon – a substance which remains incomparable to any other natural body – the descriptions of burning alcohol were certainly (and more than with any other phenomenon) the most persuasive example available that testified to the existence of vital spirits. In Bacon, the body works like a conventional still that is unfit for distilling alcohol: it is hotter in its upper parts and probably hottest in the ventricles of the brain, where the finest vital spirits are located. This idea is corroborated by Bacon's observation that 'sweat comes forth more out of the upper parts of the body than the lower; the reason is, because those parts are more replenished with spirits'.<sup>76</sup> According to Bacon, air generates itself from water, for both substances seek to enlarge their bodies; both are volatile and hence constantly attempt to leave the bodies that hold them captive.<sup>77</sup> For this reason, the combustible and volatile nature of the *spiritus* has to be kept in check. This can be done by condensing, by cooling the animate body (*densatio*) that would otherwise quickly perish.<sup>78</sup> Bacon, consequently, maintains that longevity is the result of the effective cooling of the *spiritus*. Yet it is not the entire body that has to be kept refrigerated. Bacon says that the stomach has to be well heated, just as the vessel which contains the fermented must to be put on burning coals in order to achieve an effective process of distillation.<sup>79</sup>

<sup>75</sup> Bacon, *Historia vitae* 215 'Spiritus vitalis nonnullam habeat incensionem, atque sit tanquam aura composita ex flamma et aere; [...] at illa in ansio peculiares praebet motus et facultates; etenimet fumus inflammabilis, etiam ante flammam conceptam, calidus est, tenuis, mobilis; et tamen alia res est postquam facta sit flamma; at incenso spirituum vitalium multis partibus lenior est quam mollissima flamma ex spiritu vini, atque alias; atque insuper mixta est, ex magna parte, cum substantia aerea; ut sit et flammae et aerae naturae mysterium'. In ibidem 216 (*Canon* 7), Bacon maintains that the nature of the vital spirit is more akin to the nature of the flame than to air.

<sup>76</sup> Bacon Francis, *Sylva sylvarum, opera*, 566 (§708) see also ibidem 594 (§785).

<sup>77</sup> Bacon, *Historia vitae* 216–217 (*Canon* 6).

<sup>78</sup> Bacon, *Historia vitae* 217 (*Canon* 9) and ibidem 218 (*Canon* 11).

<sup>79</sup> Bacon, *Historia vitae* 223 (*Canon* 28) 'Refrigeratio quae non transit per stomachum utilis ad longaevitatem. Explicatio. Ratio praesto est, quia cum refrigeratio non temperata, sed potens, (praesertim sanguinis) ad vitam longam sit praecipue necessaria; omnino hoc non fieri possit per intus, quantum opus est, absque destructione stomachi et viscerum'.

Equipped with this theoretical background, we are now in a position to understand Bacon's ideas about aging. He outlines various methods to promote longevity: his basic assumption consists in the traditional idea, to be found in Plato, that the lungs function as a cooling device for the heat generated by the heart, and that the aging body dies from overheating.<sup>80</sup> Bacon accordingly maintains that old age dries the body out because the *spiritus*, like a flame, consumes the organism's vital energy.<sup>81</sup> He compares this quality of the human *spiritus* to distilled wine, which burns like desiccating fire in which one can fry eggs or toast bread.<sup>82</sup> Due to this qualitative resemblance between alcohol and the *spiritus vitae*, Bacon argues strongly against the use of *aqua ardens* as a means for the prolongation of life. Rather, he wishes to see the use of mild (*benignum*) vapours, which are nonetheless alive.<sup>83</sup> And he is quick to name these substances: opiates and *nitrum* or saltpeter, since he thinks that both substances cool the spirits and therefore lead to their preservation, thus prolonging the life of the entire animal.<sup>84</sup> Bacon says that opium is the most powerful substance to make the *spiritus* condense; the drug is, therefore, not only a medicine against the plague and other malignant diseases, but also commendable for the prolongation of life in general.<sup>85</sup> Tobacco serves the same purpose, though to a lesser degree.<sup>86</sup> For our purposes it is crucial to note the extent to which the art of distillation informs Bacon's account of physiological processes: no matter whether human or from wine, the spirits have to be kept in check by being cooled; and in organic bodies, the function of the

<sup>80</sup> On the idea that the lungs are a cooling device for the heat generated by the blood from the heart, cf. Plato, *Timaeus* 79d–e, a doctrine repeated in Aristoteles, *De respiratione* 16, 475b18–20, and ibidem 21, 478a15–25. Ficino, *Appendix in Timaeum* 1477 (ch. 64) *Pulmo aerem haurit, ad incendium coris refrigerandum*. Cf. ibidem 1479/479 (ch. 81) and 1482/482 (ch. 93).

<sup>81</sup> Bacon, *Historia vitae* 115 (§ 4) [*spiritus...*] *qui corporis humorem exugit et una cum ipso evolat*. cf. also 120; cf. the contribution by Daniel Schäfer in this volume, 260.

<sup>82</sup> Bacon, *Historia vitae* 116 (§ 9) *Spititus vini fortis in tantum desiccatur instar ignis ut et abluen ovi immisum, et panem torreat*.

<sup>83</sup> Bacon, *Historia vitae* 157 (Monitum) *Cum de iis jam sermo sit quae in dietam transferri possint, aquae illi ardentiores, [...] rejicenda sint; et videndum quomodo componi possint aquae ex praecedentibus; non [...] ardentes ex spiritu vini, sed magis temperatae, et nihilominus vivae, et vaporem benignum spirantes*.

<sup>84</sup> On the cooling qualities of opium, see Galenus, *De temperamentis* I, 658–661, 94; 4. 3–94, 25.

<sup>85</sup> Bacon, *Historia vitae* 163 (§ 21) *Quicquid in cura morborum pestilentialium et malignorum foeliciter exhibetur, ut spiritus sistantur et fraenentur ne turbent et tumultuentur, id optime transfertur ad prolongationem vitae; cum idem faciat ad utrumque; condensatio videlicet spirituum. Id autem praestant ante omnia opiata*.

<sup>86</sup> Cf. Bacon, *Historia vitae* 164 (§ 27).

cooling device in the still may be best assumed by opiates.<sup>87</sup> One could even say that the methods proposed here are like the technical innovation of the cooling device that allowed for the production of alcohol in the first place: for without artificial cooling, the *spiritus* would evaporate, just as in the traditional alembics.

In light of these considerations, the recommendation to undergo a yearly treatment with opiates early in the month of May in order to keep the spirits cool, commencing in early adult life, does not come as a complete surprise to the reader of the *Historia vitae et mortis*. Even so, Bacon himself does not seem to be quite at ease with this *consilium*; for he also maintains that a distillate of opiates might be less harmful and do the same job.<sup>88</sup> He also says that this cure is a genuinely safer method (*absque malignitate aliqua, aut qualitate inimica*) to bring about the condensation of spirits by the use of coldness itself, which can also be administered moderately but on a daily basis.<sup>89</sup> Bacon recommends breathing in cool, unpolluted air, since under such circumstances the *spiritus* condenses; this treatment works best on a dry hillside or in a windy but shadowy place in the countryside.<sup>90</sup> In a similar vein, Ficino (following Avicenna) had already recommended fleeing the plague to mountainous areas, because he deemed them to be close to the lofty spheres of clean air, where one may breathe living air, akin to the spirit: 'Whether walking or sleeping, always breathe living air, air living with light'.<sup>91</sup> Yet, if this kind of salubrious

<sup>87</sup> Cf. Bacon, *Historia vitae* 164 (§ 31).

<sup>88</sup> Cf. also Bacon, *Historia vitae* 164–165 (§ 32) 'Sit itaque quotannis, a iuventute adulta, diaeta opiata. Usurpetur sub fine Maii, quia spiritus aestate maxime solvuntur et attenuatur, et minor instat metus ab humoribus frigidis: sit vero opiatum aliquod magistrale debilius quam ea quae in usus sunt, et quoad minorem quantitatem opii, et, quoad parciorem mixturam impense calidorum: sumatur mane inter somnos; victus sit simplicior et parcior, absque vino, aut aromatibus, aut vaporosis: sumatur autem medicina alternis tantum diebus, et continuetur diaeta ad quatuordecim dies'. For the version with distilled opiates, see *ibidem* § 34.

<sup>89</sup> Bacon, *Historia vitae* 165–166 (§ 38) 'Iam vero modo condensationis spirituum, per frigus, inquiremus; proprium enim frigus est densatio, atque perficitur absque malignitate aliqua, aut qualitate inimica: ideoque tutior est operatio, quam per opiata: licet paulo minus potens, si per vices tantum, quemadmodum opiata usurparetur. At rursus, quia familiariter et in victu quotidiano moderate adhiberi potest, etiam longe potentior ad prolongationem vitae est quam per opiata'.

<sup>90</sup> Bacon, *Historia vitae* 166 (§ 40) 'Aer limpidus et purus, et nihil habens fuliginis, antequam recipiatur in pulmones, et minus obnoxius radiis solis, spiritus optime densat. Talis invenitur aut in iugis montium siccis, aut in campestribus perflatilibus et tamen umbrosis'.

<sup>91</sup> Ficino, *De vita libri tres* 379f. (III, 24) 'Spirate semper et vigilantes et dormientes aerem vivum, aerem luce viventem'. Cf. Avicenna, *Opera in luce redacta ac nuper quantum ars niti potuit per Canonicos emendata* (s.l.: 1508). Anastatic reprint (Frankfurt: 1961) fol. 416rb (IV, 1, ch. 3) 'In illa vero quae est cum sanos intentio est ut exiccet aere et fiat boni odoris et

air is not available, and as in the case of opium which – both then and now – was probably consumed as a temporary relief from stressful urban life – one may also have recourse to other (perhaps less expensive) chemical substances, such as *nitrum*: Bacon argues that this ingredient of *pulvis pyrius*, or gunpowder, abhors the flame<sup>92</sup> and is therefore an appropriate remedy to cool our organism, as it is used in artificial freezing processes.<sup>93</sup> As a conclusion to these considerations, Bacon feels it expedient to reiterate the basic outline of his argument: the spirit of *nitrum* prolongs life because it cools and condenses the human *spiritus*, and makes them more immature and less vigorous, whereas distilled alcohol sets them ablaze and therefore precipitates death.<sup>94</sup> From this account it again becomes evident how far Bacon models his account of physiological processes on the distillation of alcohol: in order to stop the spirits from evaporating, as in the still, and from becoming volatile alcohol that is quickly dissipated, the human organism has to be kept as cool as possible. Only in this way can the rarefaction of spirits be reversed and retained in the body which they animate and shape; the condensed *aqua ardens* is thus returned to the wine or even to the must it originally inhabited and hence was once part of. The adverse and dangerous condition of the human spirit that burns too quickly reads like a meticulous description of the immediate and subjective sensory effects of high-percentage alcohol on the human organism; the liquid is pungent in taste, warms or even heats, and thus brings back energy, at least temporarily. This conceptualisation becomes even more evident as Bacon says that opium and nitre have such perceptible effects on the human organism because they work as vapours and are therefore much quicker to affect the vaporous *spiritus* than other substances that have to pass through the process of concoction or digestion

---

prohibeatur eius putrido cum quacumque re sit et rectificetur cum xyloaloe crudo et ama et tura [...]. Ficino Marsilio, *Consiglio contro la pestilenza*: ed. E. Musacchio (Bologna: 1983) 61 (ch. 4) Bisogna ancora, l'altre cose, cuocerle o corregere con odori buoni & [...] maxime quando la peste nasce dopo tremoti. & è più utile usare cose di luoghi arioli, odoriferi, montuosi, che altre cose; & abitare s'monti & in palco.

<sup>92</sup> Bacon, *Historia vitae* 166–167 (§ 47) 'Manifestissimum est nitrum in pulvere pyrio magnopere exhorreere flammam; unde fit ad mirabilis illa ventositas ex exsufflatio'?

<sup>93</sup> Bacon, *Historia vitae* 166 (§ 44) 'In congelatione et conglaciatione liquorum, quae nuper coepit essere in usu, per nivem et glaciem ad exteriora vasis appositas, immiscetur nitrum [...].'

<sup>94</sup> Bacon, *Historia vitae* 167 (§ 51) 'Ex his patet spiritus humanos per spiritum nitri posse frigidari et densari, et fieri magis crudos et minus acres: quemadmodum igitur vina fortia et aromata et similia spiritus incendunt, et vitam abbreviant; ita et nitrum e converso illos componit et comprimit, et facit ad longaevitatem'.



in the stomach before they can be assimilated by the blood, the vehicle of the *spiritus*.<sup>95</sup> Again, I take this to refer to the spectacular effects of alcoholic spirits on the human mind, apparently bypassing the process of digestion and being felt as they go straight to the head, thus unhealthily heating the *spiritus*.<sup>96</sup> Unlike Paracelsus, Bacon assigns to the stomach a central role in the process of digestion: in order to fulfill its function properly, this organ has to be hot, yet in a temperate way.<sup>97</sup> In the *Sylva sylvarum* Bacon gives very instructive examples which allow us to understand his method of keeping the heat inside the body. This procedure becomes a general technique of changing elements by the effects of fire, since Bacon compares the effects of the distillation of simple substances, such as wood or water, in hermetically-sealed vessels to the transformations that occur in the maternal womb.<sup>98</sup> In many other instances in the *Sylva sylvarum*, Bacon explains physiological reactions or processes as the result of the dilation or contraction of *spiritus* in specific parts of the human body.<sup>99</sup>

<sup>95</sup> Bacon, *Historia vitae* 168 (§ 57) 'Quemdamodum condensatio spiritus per subordinata ad opum fit aliquatenus per odores; similiter et illae, quae fit per subordinata ad nitrum [...]. Ibidem § 59 Dubium non est, quin refrigeratio et attemperatio sanguinis per frigida, qualia sunt endivia, chicorea, hepatica [...]. per consequens infrigidet quoque spiritus; sed hoc fit per circuitum; at vapores operantur immediate'. On the efficiency of vapours in revitalising and restoring the body, since they directly attack the *spiritus*, see also ibidem 222 (*Canon* 25).

<sup>96</sup> Bacon, *Historia vitae* 169 (§ 64), accordingly states that the beneficial quality of opium and of herbs with analogous effects (for instance, euphorbium, pyrethrum and castoreum) consists also in the fact that they are assimilated through the slow process of digestion; they warm the stomach rather than the *spiritus*, in sharp contrast to the effect of wine-spirits, for the former are not 'acria, nec mordent linguam; sed sunt paulum amara, et odoris potentis, et produnt demum caliditatem suam in stomacho et operationibus sequentibus'.

<sup>97</sup> Bacon, *Historia vitae* 186–187 (§ 4) 'Stomachus (qui, ut aiunt, est paterfamilias, et cuius robur ad reliquos concoctione est fundamentale) ita unire decet et confirmare, ut sit absque temperie calidus [...]'.  
<sup>98</sup> Bacon, *Sylva sylvarum* 383 (§ 99) 'But of all the admirable effects of this distillation close (for so we will call it) which is like the wombs and matrices of living creatures, where nothing expireth nor separateth, we will speak fully in the due place; not that we aim at the making of Paracelsus' pygmies, or any such prodigious follies; but that we know the effects of heat will be such as will scarce fall under the conceit of man, if the force of it be kept altogether in'.

<sup>99</sup> See, for instance Bacon, *Sylva sylvarum* 570 (§ 721), where Bacon maintains that 'Laughing causeth a dilatation of the mouth and the lips, a continued expulsion of the breath, with the loud noise [...] . the cause of laughing is but a light touch of the spirits, and not so deep an impression as in other passions. And therefore, [...] it is moved, and that in great vehemency, only by tickling some parts of the body; and we see that men even in a grieved state of mind, yet cannot sometimes forbear laughing [...]. the dilatation of the mouth and lips, continued expulsion of the breath and voice, and shaking of the breast... they proceed (all) from the dilatation of the spirits, especially being sudden. So likewise, the running of the eyes and water [...] is an effect of dilatation of the spirits'. For other examples, see ibidem § 722 (the effects of lust directing the *spiritus* to the affected

Bacon applies the same idea to all kinds of drinks, though with a less sophisticated cooling system, for here it is sufficient to hang closely-stoppered bottles in 'a deep well somewhat above the water for some fortnight's space, [...] for the cold does not cause any exhaling of the spirits at all; as heat does, though it rarefies the rest that remain; but cold makes the spirits vigorous'.<sup>100</sup> Bacon thus indirectly acknowledges the formative role of the technological process for his ideas about human (and, indeed, all other) physiologies. This again testifies to the deep structural similarity between the two different kinds of *spiritus* that Bacon had postulated, as well as to his willingness to acknowledge the materiality of this stop-gap in medical physiology and physics in general. Such a tendency becomes even more obvious in a passage where Bacon maintains that those spaces in living substances which are the seats of the *spiritus vitalis* become filled with air, which in turn streams into the body after it has lost its vitality. Air makes the lifeless body fragile, for it does not admit 'great diversity of hot, cold, active, dull etc., anymore'. Under the influence of dry air, the object therefore becomes 'insipid and without any extimulation'.<sup>101</sup>

### Conclusion

I hope here to have shown the extent to which the evidence produced by the art of distillation – the condensation and rarefaction of matter or of the principle intrinsic to it – informed Ficino's metaphysics and how, in different ways, his Neoplatonic outlook influenced Bacon's and Duchesne's ideas of human physiology. For Ficino, the actual apparatus and the practical arts of the distillers seem to have been only of marginal

---

parts of the body); ibidem § 724 (the animal spirits are oppressed by the spirits of wine, which causes the typical symptoms of drunkenness); see also ibidem 576 (§ 735); 586–587 (§ 766), where Bacon maintains that a tickling in the soles of the feet and in other parts of the body 'is a light motion of the spirits, which the thinness of the skin, and suddenness of and rareness of touch, do further: for we see a feather [...] drawn along the lip or cheek, doth tickle; whereas a thing more obtuse, or a touch more hard doth not'. Bacon also adapts the traditional doctrine that a kind of *spiritus vitalis* is emitted by the eye as a visual ray: he therefore maintains that 'We see more exquisitely with one eye shut, than with both open. The cause is, for that the spirits visual unite themselves more, and so become stronger: For you may see by looking in a glass, that when you shut one eye, the pupil of the other eye that is open dilateth' (§ 868).

<sup>100</sup> Bacon, *Sylva sylvarum* 446 (§ 315). See also ibidem 454 (§ 341) '[...] and this (sc. cold) worketh by the detention of the spirits'.

<sup>101</sup> Bacon, *Sylva sylvarum* 616 (§ 842).

importance. Perhaps it was precisely this very distance from hands-on experience that allowed Ficino to endow the art with the cosmic significance that became so important for later generations of doctors and natural philosophers alike. In Duchesne, we encountered a passage that testifies to his close acquaintance with contemporary stills and his willingness to relate his practical experience to Paracelsian metaphysics. Francis Bacon constructs a still of his own invention, in order to quantify the universal spirit, and links his experimental results to the Paracelsian and alchemical traditions. Common to all these thinkers is the fact that the results of the technology of wine-distillation provided an explanatory foil to account for a great variety of phenomena. It explained aging of the human body, and introduced a model for health and disease that became an alternative to the equilibrium of the four humours; although contested by various authors,<sup>102</sup> the distillation of alcohol simplified the doctrine of vital spirits, reducing them from three to one; the apparatus necessary for distillation as well as its product, combustible alcohol, contributed to the feasibility of materialist explanations for all kinds of physiological phenomena, as for many authors the *aquavit* credibly became a substance that was endowed with life, motion and sensibility. Yet, on the side of the practitioners, the tide was already turning; in Oswald Crollius' *Basilica chymica* (1609), 'the emphasis on distillation techniques characteristic of medieval alchemists and still dominant in the work of Paracelsus had disappeared'. For that author was 'one of the first chemical writers to emphasise the real chemical product of a reaction – rather than the distillate or the quintessence as the desired substances to be collected'.<sup>103</sup>

---

<sup>102</sup> Edward O'Meara is a case in point: for this late seventeenth-century Galenic physician and his attacks on the Paracelsian Thomas Willis, see Clericuzio, "Internal Laboratory" 61 and 68 with n. 113. On the criticisms of Robert Boyle, *ibidem* 64.

<sup>103</sup> Debus, *Chemical Philosophy* 123–124; on Crollius see *ibidem* 117–126.

*Selective bibliography*

- ANONYMUS, *De quinta essentia libri II* (Strasbourg, Balthasar Beck: 1541)
- ARISTOTLE, *Meteorologica*: tr. Lee H.D.P. (Cambridge, Mass.: 1952).
- AVICENNA, *Opera in luce redacta ac nuper quantum ars niti potuit per Canonicos emendata* (Venice: 1508) [anastatic reprint: Frankfurt 1961].
- BACON FRANCIS, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874).
- , *The Instauration Magna Part II. Novum Organum and Associated Texts*: eds./trs. (etc.) Rees G. – Wakely M. (Oxford: 2004).
- BIANCHI M.L., “The Visible and the Invisible: From Alchemy to Paracelsus”, in Rattansi P. – Clericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 17–50.
- BIGGS J.C., *Francis Bacon and the Rhetoric of Nature* (Cambridge, Mass.-London: 1989).
- CALVET A., “Mutations de l'alchimie médicale au XV<sup>e</sup> siècle: A propos des textes authentiques et apocryphes d'Arnaud der Villeneuve”, *Micrologus* 3 (1995) 185–210.
- CLERICUZIO A., “The Internal Laboratory: The Chemical Reinterpretation of Medical Spirits in England (1650–1680)”, in Rattansi P. – Clericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 51–85.
- COLNORT-BODET S., “Eau-de vie logique et ‘Banqueroutiers du Saint-Esprit’”, in Morazé Ch. – Aron R.C.F. (eds.), *Culture science et développement. Mélanges en l'honneur de Charles Morazé* (Paris: 1979) 297–336.
- COPENHAVER B.P., “Scholastic Philosophy and Renaissance Magic in the ‘De vita’ of Marsilio Ficino”, *Renaissance Quarterly* 37 (1984) 523–584.
- CHRISTIE J.R.R., “The Paracelsian Body”, in Grell O.P. (ed.), *Paracelsus. The Man and his Reputation, his Ideas and their Transformation* (Leiden-Cologne: 1998) 269–291.
- DEBUS A.G., *The Chemical Philosophy* (New York: 1977).
- DELEULE D., “Francis Bacon alchimiste de l'esprit humain”, *Les études philosophiques* 3 (1985) 291–301.
- DEVUN L., *Prophecy, Alchemy, and the End of Time. John of Rupescissa in the Late Middle Ages* (New York: 2009).
- DUCHESNE JOSEPH, *Liber de priscorum philosophorum verae medicinae materia* (Paris: 1603).
- EAMON W., *Science and the Secrets of Nature. Books of Secrets in Medieval and Early Modern Culture* (Princeton, NJ.: 1994).
- ECKSTEIN F., “Brantwein”, in Bächtold-Stäubli H. – Hoffmann-Krayer E. (eds.), *Handwörterbuch des deutschen Aberglaubens*, 10 vols. (Berlin-Leipzig: 1927–1942).
- FICINO MARSILO, *Appendix in Timaeum* (Basel, Heinrich Petri: 1576) [*Opera omnia*], 1466–1485.
- , *Consiglio contro la pestilenza*: ed. Musacchio E. (Bologna: 1983).
- , *De vita libri tres*: eds./trs. Kaske C.V. – Clark J.R. (1989), *Three Books of Life*, Binghamton, NY [= *De vita*].
- , *In librum de coelo* (Basel, Heinrich Petri: 1576) [*Opera omnia*], 1536–1800.
- , *In Plinium* (Basel, Heinrich Petri: 1576) [*Opera omnia*].
- , *In Theophrastum* (Basel, Heinrich Petri: 1576) [*Opera omnia*], 1801–1836.
- , *Opera omnia* (Basel, Heinrich Petri: 1576) [Anastatic reprint: Turin: 1962].
- , *Théologie platonicienne de l'immortalité des âmes*: ed./tr. Marcel R., 3 vols. (Paris 1964–1970).
- FORBES R.J., *Short History of the Art of Distillation from the Beginnings up to the Death of Cellier Blumenthal* (Leiden: 1948).
- GARZONI TOMMASO, *Il teatro de' vari e diversi cervelli umani*, ed. Cherchi P. (Ravenna: 1999).

- GEMELLI B., *Aspetti dell atomismo nella filosofia di Francis Bacon e nel seicento* (Florence: 1996).
- HANNAWAY O., *The Chemists and the Word. The Didactic Origins of Chemistry* (Baltimore-London: 1975).
- HOLMYARD E.J., *Alchemy* (Harmondsworth: 1957).
- KAHN D., *Alchimie et Paracelsisme en France (1567–1625)* (Geneva: 2007).
- KHUNRATH HEINRICH, *Amphitheatrum sapientiae verae christiano-cabbalisticum* [...]. (Hanover: 1609).
- MATTON S., "L'influence de l'humanisme sur la tradition alchimique", *Micrologus* 3 (1995) 279–345.
- , "Marsile Ficin et l'alchimie, sa position, son influence", in Margolin J.C. – Matton S. (eds.), *Alchimie et philosophie à la Renaissance* (Paris: 1993) 123–192.
- McKEE F., "The Paracelsian Kitchen", in Grell O.P. (ed.), *Paracelsus. The Man and his Reputation, his Ideas and their Transformation* (Leiden-Cologne: 1998) 293–307.
- MOTHU A., "Le mythe de la distillation de l'âme au XVII<sup>e</sup> siècle en France", in Margolin J.C. – Matton S. (eds.), *Alchimie et philosophie à la Renaissance* (Paris: 1993) 435–461.
- MULTHAUF R.P., "Distillation", in Strayer J.R. (ed.), *Dictionary of the Middle Ages* (New York: 1984), vol. 4, 219–220.
- , "John of Rupescissa and the Origin of Medical Chemistry", *Isis* 45 (1954) 359–367.
- NEWMAN W., "Technology and Alchemical Debate in the Late Middle Ages", *Isis* 80 (1989) 423–445.
- NUSSBAUM M.C., *Aristotle's De motu animalium* (Princeton: 1978).
- PAGEL W., *Das medizinische Weltbild des Paracelsus. Seine Zusammenhänge mit Neuplatonismus und Gnosis* (Wiesbaden: 1962).
- , *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance* (Basel-New York: 1958).
- PEREIRA M., "Heavens on Earth: From the *Tabula Smaragdina* to the Alchemical Fifth Essence", *Early Science and Medicine* 5 (2000) 131–144.
- , "Medicina in the Alchemical Writings attributed to Raimond Lull (14th–17th centuries)", in Rattansi P. – Clericuzio A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994) 1–16.
- PORTA GIAMBATTISTA DELLA, *De distillationibus libri IX* (Strasbourg, L. Zetzner: 1609).
- , *Della magia naturale libri XX* (Naples, Carlino Vitale: 1611).
- , *Natural Magick* (London, T. Young – S. Speed: 1658) (= English translation of the 2nd ed. of the *Magia naturalis*, anastatic reprint, New York: 1957).
- PUTSCHER M., *Pneuma Spiritus Geist. Vorstellungen vom Lebensantrieb in ihren geschichtlichen Wandlungen* (Wiesbaden: 1974).
- RATTANSI P. – CLERICUZIO A. (eds.), *Alchemy and Chemistry in the 16th and 17th centuries* (Dordrecht-Boston-London: 1994).
- ROSSI P., *Francis Bacon. From Magic to Science*, tr. Rabinovitch S. (London: 1968).
- SAVONAROLA MICHELE, *I trattati in volgare. Della peste e dell'acqua ardente*, ed. Belloni L. (Milan: 1963).
- SIRAISSI N.G., *Medieval and Renaissance Medicine* (Chicago-London: 1990).
- TAYLOR F.S., "The Evolution of the Still", *Annals of Science* 5 (1945) 117–138.
- WALKER D.P., "Medical Spirits in Philosophy and Theology from Ficino to Newton", in Gouk P. (ed.), *Music, Spirit and Language in the Renaissance* (London: 1985).
- , "The Astral Body in Renaissance Medicine", *Journal of the Warburg and Courtauld Institutes* 21 (1958) 119–133.
- WALLACE K.R., *Francis Bacon on the Nature of Man* (Urbana-Chicago-London: 1967).

## THE BODY IS A BATTLEFIELD. CONFLICT AND CONTROL IN SEVENTEENTH-CENTURY PHYSIOLOGY AND POLITICAL THOUGHT

Sabine Kalff

### *Summary\**

In many different ways, early modern political thinkers concerned themselves with physiology and adopted physiological concepts of motion to explain political dynamics. This article will examine the mutual inspiration between physiological and political concepts of motion, based on the example of Tommaso Campanella and Francis Bacon, as these political philosophers displayed such a strong interest in physiology that they themselves even wrote on it extensively. Both of them were medical laymen and conceived of physiology as a speculative science concerned with investigating the principles that were at work in the whole of nature, not only in living beings. It will be argued that physiological processes, such as the generation of motion and heat, its regulation or self-regulation, and the interaction between the bodily organs, came to provide a heuristic model for the analysis of dynamics in the political sphere. The frequent references to physiology will be understood as an important contribution to the process of medicalisation of governmental techniques and political analysis.

While studies of the body politic generally agree that anatomy provided an important model for political thought as far as the analysis of the structural organisation of a state and the distribution of power is concerned, physiology is rarely supposed to have exerted any noteworthy influence on political thought.<sup>1</sup> As other papers in this collection have demonstrated, the modern distinction between anatomy and physiology was alien to early modern medicine. Early modern physiology was only partly concerned with what the modern branch of medicine focuses on – the analysis of the function of bodily parts and organs – and it covered equally the study of elements, temperaments, humours, spirits and faculties, as

---

\* I am particularly grateful to Alan Suter for revising the English of my text, to Vivian Nutton for allowing me a preview of his article in this volume (27–40), and to the three anonymous readers for their helpful comments.

<sup>1</sup> See for instance Hale D.G., *The Body Politic. A Political Metaphor in Renaissance English Literature* (The Hague-Paris: 1971).

well as anatomical structures of the organs.<sup>2</sup> Thus, in the first paper of this volume, Vivian Nutton argues that anatomical and physiological studies in the Early Modern period overlapped to the extent that the titles of treatises referring either to anatomy or to physiology were interchangeable, although 'physiology' had the advantage of gaining some fashionable appeal after Jean Fernel famously applied it to a part of his *Medicina* (1554).<sup>3</sup> Obviously, this 'physiological trend' not only appealed strongly to medical writers, but also to political philosophers who proved equally inclined to regard the dynamics of bodily humours, nerves, muscles and spirits as heuristic models for the understanding of political processes, particularly with regard to their regulation and self-regulation.

Although numerous physiological treatises were published at the beginning of the seventeenth century, their influence on political thought has not yet been studied very much – with the remarkable exception of William Harvey. The relevance of his model of a closed-circuit blood circulation to the reflection of political dynamics has been analysed thoroughly, and has perhaps even been over-emphasised.<sup>4</sup> But most political philosophers have still not been considered in this context, although some of them displayed such a strong concern for physiology that they themselves even wrote on it extensively.

This particularly holds true for two medical laymen, Tommaso Campanella and Francis Bacon, who were not only both acclaimed authors of utopian treatises, but also put forward physiological theories which were closely connected with their political thought – and activity. To speak explicitly of physiological theories despite the lack of a clearly delineated dichotomy between the branches of anatomy and physiology seems justified in the first place by the fact that neither Campanella nor Bacon ever seems to have written much on anatomy. Moreover, their almost exclusive commitment to physiology resulted from the early modern concept of physiology, which since Greek Antiquity was conceived rather as a general study of nature and of the principles underlying all natural phenomena than as a specific branch of medicine.<sup>5</sup> Hence, the specific proceedings in human beings were thought to be explicable in terms

---

<sup>2</sup> Bylebyl J.J., "Disputation and Description in the Renaissance Pulse Controversy", in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 224.

<sup>3</sup> Cf. Nutton V., "Physiologia: From Galen to Jacob Bording", this volume 35.

<sup>4</sup> Cf. Hill C., "William Harvey and the Idea of Monarchy", *Past and Present* 27 (1964) 54–72. See also Cohen B.L., "Harrington and Harvey: A Theory of the State based on the New Physiology", *Journal of the History of Ideas* 55, 2 (1994) 187–210.

<sup>5</sup> Cf. Nutton, "Physiologia" 28.



of more general principles that controlled not only human beings, but also the whole universe. From this perspective, physiology was the most speculative and general of the medical disciplines<sup>6</sup> and, as such, appealed strongly to the medical laymen Campanella and Bacon, both of whom lacked experience with practical anatomical studies but were certainly adept in natural philosophy.

*Political Fever and Cosmic Conflict in Tommaso Campanella*

The Calabrian theologian and philosopher Tommaso Campanella, best known for his utopian treatise *La Città del Sole* (1623),<sup>7</sup> not only wrote on political theory, natural philosophy and astrology but was also the author of two lengthy medical treatises, the *Medicinalium iuxta propria principia libri septem* (1635) and the *Epilogo magno* or *Fisiologia italiana* (1623).<sup>8</sup> The redaction process of the *Fisiologia italiana* was complicated, but Campanella called the book *Physiologia* from the first version onwards, which dated back to 1592.<sup>9</sup> In the ancient Greek sense of *physiologia*, understood as a thorough investigation into the *physis* of a thing,<sup>10</sup> Campanella's physiology indeed discussed a wide range of natural phenomena, of which the physiology of the human body formed only a part.<sup>11</sup> Campanella's second

<sup>6</sup> Cf. Bylebyl, "Disputation and Description" 226.

<sup>7</sup> All dates refer to the first printed editions. The manuscript was written much earlier, about 1602. Cf. Firpo L., "Introduzione", in Campanella Tommaso, *La Città del Sole*, ed. Firpo L. (Rome-Bari: 1997) xxxi.

<sup>8</sup> The final Latin version of the treatise was composed between 1604 and 1609. Cf. Mönnich M.W., *Tommaso Campanella. Sein Beitrag zur Medizin und Pharmazie der Renaissance* (Stuttgart: 1990) 35. The Italian manuscript remained unpublished until 1939. See Ottaviano C., "Prefazione", in Campanella Tommaso, *Epilogo magno (Fisiologia italiana)*, ed. Ottaviano C. (Rome: 1939) 19. The most comprehensive study of Campanella's medical theories remains the one by Mönnich. On the philosophical premises of Campanella's medical thought Couzinet M.-D., "Notes sur les Medicinalia de Tommaso Campanella", *Nunciis* 13 (1998) 39–67; Giglioni G., "La Medicina di Tommaso Campanella tra metafisica e cultura popolare", in Ernst G. – Fiorani C. (eds.), *Laboratorio Campanella. Biografia – Contesti – Iniziative in Corso*. Atti del Convegno della Fondazione Camillo Caetani. Roma, 19–20 ottobre 2006 (Rome: 2007) 177–195; Giglioni G., "Healing and Belief in Tommaso Campanella's Philosophy", *Intellectual History Review* 17 (2007) 225–238. On Campanella's theory of conception Giglioni G., "Immaginazione, spiriti e generazione. La teoria del concepimento nella *Philosophia sensibus demonstrata* di Campanella", *Bruniana & Campanelliana* 4 (1998) 37–57.

<sup>9</sup> Cf. Ottaviano, "Prefazione" 19.

<sup>10</sup> Cf. Nutton, "Physiologia" 30.

<sup>11</sup> Book I is on cosmology and astronomy, book II on meteorology and geophysics, book III on minerals, book IV on botanics, book V on animals and humans, including generation, embryonic development, anatomy and physiology. The physiological part treats both

important medical treatise, the *Medicinalia*, was devoted exclusively to medical issues, but anatomical and physiological questions were treated mainly in the opening book. These 34 pages constitute only 5% of the whole treatise, but anatomical and physiological topics are also touched on elsewhere, as for instance with regard to pathology, which is discussed at length in the sixth book.<sup>12</sup>

After having presented a pathology based on a topological classification – a *pathologia secundum partes corporis humani* – in the sixth book, Campanella dedicated the seventh book of the *Medicinalia* entirely to fevers, which were conceived as a class of diseases affecting not only parts, but the whole of the human body,<sup>13</sup> as he asserted in the *Epilogo magno*: ‘every fever manifests itself in the whole body’.<sup>14</sup> Finally, Campanella put forward such an appreciative theory of fever that one rather starts looking forward to becoming affected by a fever as soon as possible. According to Campanella, fever constituted no menace to physical health, but was rather a bodily device of defence against illness. He held that fever was ‘not a disease, but a war against disease, undertaken by means of a powerful force possessed by spirit’.<sup>15</sup> The imagery of warfare was not entirely unfamiliar to theories of fever. Generally, it made its appearance within the context of crisis. Fever theory implied that a final crisis, perceived as the decisive phase of an illness, was to occur in all acute, but not in chronic, forms of fever. In this context, crisis was either understood in juridical terms as a final judgment by which the fate of a patient was to be decided, or in military terms, as a decisive battle between nature and disease. The latter concept came to be promoted by Avicenna and, from that time onwards, exerted a strong influence on medical thought. Although the imagery of a battle between health and disease had an established tradition in pathology, particularly with

---

anatomy and physiology, discussing the components of the human body (*humores, partes solidae*, bones), and physiological processes in the modern sense, such as digestion, blood movement and reproduction, and the functioning of heart and lungs. The sixth book covers psychological, ethical and pathological issues. Cf. Campanella, *Epilogo magno* 573–577.

<sup>12</sup> Cf. Campanella Tommaso, *Medicinalium iuxta propria principia libri septem* (Lyons, Pillehotte for Caffin and Plignard: 1635).

<sup>13</sup> This twofold classification of pathology may be traced back to medieval Arabic medicine. Cf. Dell’Anna G., *Dies critici. La teoria della ciclicità delle patologie nel XIV secolo (Dies et crises)* (Lecce: 1999) vol. 1, 174.

<sup>14</sup> ‘Ogni febbre si fa in tutto il corpo’. Campanella, *Epilogo magno* 540. Translations from the Italian by the author.

<sup>15</sup> Cf. Campanella, *Medicinalia* 603–609. Campanella on fever will be cited here in the English translation of book VII, ch. II, article I, contained in Rather L.J. – Frerichs J.B., “On the Use of the Military Metaphor in Western Medical Literature: The *Bellum Contra Morborum* of Thomas Campanella (1568–1639)”, *Clio Medica* 7 (1972) 202.

regard to the concept of crisis, Campanella put it forward in a way that was different and original. First of all, fever had changed sides – it was no longer conceived as an expression of illness, but as a powerful instrument of a positive internal bodily force, the healing force of nature, or *vis naturae medicatrix*.<sup>16</sup> Hence, fever was a part of nature, ‘desiring to do battle and to produce a crisis, so that fever is obviously no evil, but a remedy against evil, to be applied when and where there is need’.<sup>17</sup> Thus, Campanella depicted the human body affected by fever as a battleground where two powerful combatants encountered each other: fever as a means of the *vis naturae medicatrix* and disease as an inimical force.

As a consequence, contrary to the tradition derived from Avicenna, fever was not perceived as a form of extraneous heat invading the human body, but as an intrinsic bodily force defending health against an inimical intruder, which came to be identified with disease. According to Campanella, fever was not at all preternatural, but only ‘natural heat converted into fiery heat’.<sup>18</sup> Although the Hippocratic tradition also approved of natural heat as an important physiological device, it did not appreciate bodily heat to any degree. Campanella, on the other hand, instead advocated the principle ‘the more the better’ with regard to temperature, and declared:

Just in this way is the issue decided between nature and disease, when the disease had arrived at its greatest development – especially when one most forceful febrile paroxysm comes on the heels of others.<sup>19</sup>

As the philosopher equated the intensity of heat to the intensity of warfare, he came to regard fever as indicative of a strong military engagement. From this belligerent point of view, the presence of fever was by far preferable to its absence, as the absence was supposed to signify the surrender of the body to illness. And the more the temperature increased, the more warfare was supposed to be under way. Admittedly, fever sometimes looked like disorder, causing interruptions and confusions of the normal physiological functioning. In Campanella’s view, this was nothing to worry about, but only a temporary suspension of the normal functions, comparable to the state of emergency in political life:

Thus when a state is fighting against an enemy public works, agriculture and festivals are held up; but fever does not occur in order that matters be

---

<sup>16</sup> For the history of the medical idea of the healing force of nature, see Neuburger M., *Die Lehre von der Heilkraft der Natur im Wandel der Zeiten* (Stuttgart: 1926).

<sup>17</sup> Campanella, *Medicinalia*, tr. Rather – Frerichs 203.

<sup>18</sup> Campanella, *Medicinalia* 204.

<sup>19</sup> Campanella, *Medicinalia* 202.

impeded, but to the end that an enemy may be removed and thus the spirit, now safe, may peaceably return to its functions.<sup>20</sup>

In short, fever led to the suspension of the normal physiological functions of the human body in the same way as the state of war led to a temporary cessation of civil proceedings in a political entity. As this self-defensive warfare only occurred 'when and where there is need,' external regulation was not required at the level of physiology. Campanella's hypothesis of the self-regulatory character of fever was a rather visionary insight, as it is still shared by today's physiology. Fever – in contrast to hypothermia which constitutes an unregulated rise due to internal or external heat – is regarded as a regulated rise in body temperature and is in fact supposed to be self-regulatory.<sup>21</sup> Furthermore, Campanella's definition of fever as a self-defensive reaction was soon endorsed by Jan Baptist van Helmont, and later proved particularly influential to the military scenario of inflammation, as it was developed by nineteenth-century bacteriology.<sup>22</sup>

Campanella not only accepted the physiological state of emergency due to warfare as a kind of necessary evil, but approved explicitly of the violent dynamics caused by fever: 'Nor is it preternatural to have a fever, unless it is preternatural to wage war when necessary, to attack an injurious enemy, to repel force by force'.<sup>23</sup> While rejecting Avicenna's notion of fever as a preternatural physiological state, Campanella further suggested that the feverish bodily warfare, besides being natural, was also legitimate – or, in other words, it constituted a just war. The question whether the conflict between nature and disease was to be regarded as a just or unjust war, and whether the use of violence was allowed when serving the aim of self-defence, necessary for survival, was somewhat new to pathology. Campanella derived his fever theory from a more general physiological speculation, conceived as an investigation into the nature of things. Furthermore, the antagonistic and self-regulatory scenario underlying his notion of fever was strongly related to the author's political ideas and activity which resulted in his confinement for twenty-seven years.

Before giving literary expression to his social and political visions in *La Città del Sole*, Campanella had tried first to realise this new form of

<sup>20</sup> Campanella, *Medicinalia* 205.

<sup>21</sup> Cf. Leon L.R., "Cytokine Regulation of Fever: Studies Using Gene Knockout Mice", *Journal of Applied Physiology* 92, 6 (2002) 2648.

<sup>22</sup> This is the central argument of the article by Rather and Frerichs. Cf. Rather – Frerichs, "On the Use of the Military Metaphor" 201.

<sup>23</sup> Campanella, *Medicinalia* 204.

government and society in this world, as the intellectual leader of the Calabrian conspiracy of 1599. Sent back by the heads of the Dominican order in 1598 to his native countryside, where it was hoped that the rebellious monk would find less of an audience for his unorthodox philosophical views, Campanella started to predict the advent of an imminent universal crisis, due in the year 1600. His central argument for the 'critical' character of the year 1600 was based on a numerical observation – its being composed of seven and nine, two fatal numbers, according to Pythagoras. He thus held that 'as the year 1600 is composed of seven hundred and nine hundred, it is obvious that it is critical and decisive to the crucial changes of terrestrial affairs'.<sup>24</sup> This speculation was a creative and conscious variation of medical concepts of crisis,<sup>25</sup> particularly the theory of critical days as put forward by the Hippocratic tradition, but which was equally based on the relevance of Pythagorean numbers. But towards the end of the sixteenth century, it was not absolutely necessary to practise numerical speculation, to listen to the voice of God or to decipher stellar messages in the sky in order to predict a crisis in southern Italy, as there were many indicators closer at hand. As a part of the Kingdom of Naples, from 1517 onwards Calabria was under Spanish rule and saw a process of re-feudalisation in the second half of the sixteenth century. The collaboration of the Spanish administration with the local aristocracy<sup>26</sup> brought about severe conflicts on jurisdiction with the Italian communes and the clergy. The absence of any central force able to enforce laws countrywide led to a state of utter lawlessness<sup>27</sup> and a high tide of banditry.<sup>28</sup> In this political climate, Campanella did not limit himself to preaching about the advent of a new political order but also strongly recommended lending a hand in its creation.<sup>29</sup> By the summer of 1599, a network of conspirators from almost all social strata had emerged, intending to overthrow the Spanish rule with the military support of the powerful local bandits and the Turkish fleet. Although the conspiracy failed before any concrete

---

<sup>24</sup> Campanella Tommaso, *Secondo schema delle difese di Fra Tommaso Campanella. Articoli profetali da inserire nelle difese di Campanella*, in Firpo L. (ed.), *Il supplizio di Tommaso Campanella. Narrazioni – Documenti – Verbalì delle torture* (Rome: 1985) 169.

<sup>25</sup> Campanella, *Secondo schema delle difese* 167.

<sup>26</sup> Villari R., *The Revolt of Naples* (Cambridge etc.: 1993) 105.

<sup>27</sup> '[...] the lawlessness that normally prevailed had reached epic proportions by the last decade of the sixteenth century'. Headley J.M., *Tommaso Campanella and the Transformation of the World* (Princeton, NJ: 1997) 32.

<sup>28</sup> Cf. Villari, *The Revolt of Naples* 34.

<sup>29</sup> Cf. Amabile L., *Fra Tommaso Campanella. La sua congiura, i suoi processi e la sua pazzia* (Naples: 1882), vol. 1, 150.

plan was put into action, the attempt to initiate a 'just war' against the Spanish monarchy made it clear that Campanella meant to 'repel force by force' at a very real political level. His concrete political action obviously concurred with his advocating aggression as a legitimate expression of self-defence with regard to fever, as he declared: 'I believe that all fever is a state of wrath, I mean an arousal of spirit for defence, that is, for slaughter and extrusion of an inimical cause'.<sup>30</sup> In other words, Campanella's description of fever as a means of self-defence against an inimical intruder, and his reference to the medical concept of crisis, may also be read against the background of the Spanish rule over south Italy where it functions as a medical justification of political resistance and opposition against an 'unjust' rule. Medical arguments and those derived from natural philosophy here seemingly provided an alternative to the well-known legal legitimations of political resistance.

Campanella also made explicit that spirits were the vehicle of the natural force of healing for warfare and self-defence. Here, the early modern theory of *spiritus* came into play, which relied heavily on ancient physiological thought, particularly of Galenic provenance. Campanella and other early modern advocates of a theory of spirits, like Jean Fernel, conceived of *spiritus* as a kind of vitalising principle of a subtle, volatile substance which also required a more solid means of transportation throughout the body, which came to be identified as blood. Spirits, of course, were held responsible not only for fever but also for a wide range of bodily functions, such as perception, motion, and the renewal of innate heat. After being inspired by Bernardino Telesio's theory of *sensus*, Campanella related *spiritus* closely to *sensus*, a kind of animate principle inherent in all matter endowing it with a kind of basic sensory perception which enabled it to take notice and to interact.<sup>31</sup> But as spirits were supposed to be consumed while fulfilling their manifold physiological duties, continuous regeneration was required in order to maintain vitality. Campanella assumed that the process of generation of spirit was thoroughly dependent on the equally incessant process of producing blood. As blood was supposed to be the end product of digestion, spirits were thought to emerge in the same way: through the ingestion of food which was gradually transformed and refined on its way through the three principal organs, liver, heart, and

<sup>30</sup> Campanella, *Medicinalia* 203.

<sup>31</sup> Cf. Campanella Tommaso, *Del senso delle cose e della magia*, ed. Ernst G. (Rome-Bari: 2007) 13.

brain. En route through the very hierarchical human body, the travelling spirits underwent processes of concoction and division which brought about significant changes in their material quality.

According to Campanella, the process of transformation and refinement reached its culmination in the brain; more precisely, in the retiform plexus. Here, rather than refinement through concoction, a multiplication of spirits by means of division took place, as Campanella pointed out in the *Epilogo magno*: 'The retiform plexus is made for chopping the blood into pieces and thus to create immediately many spirits'.<sup>32</sup> Although Campanella generally took into account the traditional distinction between three species of *spiritus* – *spiritus naturalis*, *spiritus vitalis*, and *spiritus animalis* – in his discussion of fever, he made no reference to any specific kind of *spiritus*. Campanella only referred very generically to the spirits engaged in warfare, and tended to treat them as a homogeneous species. So it was spirits in general who were supposed to gather for military recruitment when they received the musical signal given by the rhythmical beat of the pulse: 'Therefore this sort of an increase of pulsations indicates that need has decided that many spirits are recruited to come into the place, in the war'.<sup>33</sup> Although it is frequently supposed that physiological theories assumed a kind of composite of decentralised sub-systems lacking coherence and unity before Harvey's theory of a closed-circuit blood circulation postulated blood as a homogeneous substance,<sup>34</sup> Campanella's fever theory displayed traits of homogenisation as far as spirits were concerned. Besides this generalised concept of spirits, Campanella also emphasised the value of their mere quantity – no matter what their quality may be, suffice that they were many. As a large number of spirits and a high intensity of body motion and heat guaranteed a strong military engagement in the battle, the heightened physiological activity due to fever appeared almost as a heightened state of health. These tendencies to generalise spirits, to appreciate multiplication and acceleration, further indicated a slight shift towards the simplification and quantification of the traditional theory of medical spirits.

<sup>32</sup> Campanella, *Epilogo magno* 362.

<sup>33</sup> Campanella, *Medicinalia* 203. For Campanella's insistence on the music's impact on the motion of the spirits see Ernst G., *Tommaso Campanella. Il libro e il corpo della natura* (Rome-Bari: 2002) 186.

<sup>34</sup> See for instance Klier with regard to Jean Fernel. Klier G., *Die drei Geister des Menschen. Die sogenannte Spirituslehre in der Physiologie der Frühen Neuzeit* (Stuttgart: 2002) 54.



Campanella's approval of the powerful motion of spirits and other bodily fluids, such as blood, was based on more general physiological principles which were thought to underlie nature as a whole. Thus, the author concluded that perpetual motion was the 'natural' state of all things, animate as well as inanimate. As a consequence, Campanella was more concerned with the encouragement of motion than with its decrease or regulation. The antagonistic principle that brought about conflict was also used to explain the formation and preservation of Creation, as it came into being right at the beginning of the world:

God ordained that from this mass of tangible matter two intangible artificers should emerge who could not remain without a body. And hence the Warmth and the Cold were born, as active principles, albeit with an expansive tendency. Immediately they became adversaries, since both of them wanted to occupy the whole of the material space: therefore they began to fight against each other, since God had ordained that this discord should be the source of much benefit.<sup>35</sup>

As the antagonistic principle was derived from physiological speculation, it was obviously thought to apply not only to living beings, but also to all sorts of natural phenomena occurring in all spheres. As a consequence, conflict and antagonism could not possibly be adverse to nature, but worked for her benefit and expansion from the very beginning. The antagonistic structure at the basis of Campanella's fever theory served not only to explain the preservation of motion at the level of physiology but was also extended to the political and societal sphere. By ennobling conflict as a generative principle, Campanella moved surprisingly close to one of his opponents in the sphere of political thought, Niccolò Machiavelli. In the *Discourses on the first decade of Titus Livius* (1531), Machiavelli put forward the question by which means the preservation of a state could be ensured. With this concern, the famous Florentine distinguished between two types of states: on the one hand, static republics such as Sparta, which aimed at maintaining a well-established constitution, and on the other, expansionist states such as the Roman republic, whose constitution underwent considerable changes over time. While the Spartan republic owed its stability to its foundation on an ideal constitution, the perfect mixture of the Roman republic was supposed to result from discord and conflict. Thus, the *status mixtus* of the Roman republic, its ideal composition of elements of the three pure forms of government – monarchy, aristocracy

---

<sup>35</sup> Campanella, *Epilogo magno* 194f.

and democracy – evolved from a basic antagonism underlying Machiavelli's famous dynamic principle:

But let us come to Rome. Notwithstanding that it did not have a Lycurgus to order it in the beginning in a mode that would enable it to live free a long time, nonetheless so many accidents arose in it through the disunion between the plebs and the Senate, that what an orderer had not done, chance did.<sup>36</sup>

The stability of the Roman republic was hence supposed to result from the constructive collision of two antagonistic interests. Moreover, conflicts generally appeared to be beneficial to political life, as Machiavelli declared: 'in every republic there are two diverse humours, that of the people and that of the great; and all the laws that are made in favour of freedom arise from their disunion'.<sup>37</sup> Machiavelli, just like Campanella, saw no necessity to control or regulate these dynamics for the benefit of politics, but rather feared their slowing down. Therefore, he scrutinised the possibilities of maintaining and renewing the motion of political bodies in order to retain their vitality: 'And it is a thing clearer than light that these bodies do not last if they do not renew themselves. The mode of renewing them is, as was said, to lead them back to their beginnings'.<sup>38</sup> Motion seemed not only to be the 'natural' state of affairs, both in nature and politics, but was also advocated as an important means of preserving a state.

State preservation became an important political objective to be pursued by governmental techniques in the debate on the 'reason of state' which developed later in the sixteenth century. Giovanni Botero, the author of the first treatise on reason of state, *Della ragion di stato* (1589), famously declared: 'State is a stable rule over peoples, and Reason of State is the knowledge of the means by which such a dominion may be founded, preserved and expanded'.<sup>39</sup> The concern for preservation of states, considered by Botero to be by far the most important task, in fact permeated the whole discussion of reason of state. Moreover, it very probably emerged from the medical discourse on epidemics, as Colin Jones has argued: 'Thus, the language of 'preservation,' which originates in the medical script and is oriented around the individual, spreads to the political

<sup>36</sup> Machiavelli Niccolò, *Discourses on Livy* I, 2 (Chicago-London: 1996) 14.

<sup>37</sup> Machiavelli, *Discourses on Livy* I, 4, 16.

<sup>38</sup> Machiavelli, *Discourses on Livy* III, 1, 209.

<sup>39</sup> Botero Giovanni, *Della ragion di stato. Con tre libri delle cause della grandezza delle città, due aggiunte e un discorso sulla popolazione di Roma*, ed. Firpo L. (Turin: 1948) 3.

script, where the preservation of the whole community is at issue'.<sup>40</sup> Two factors were crucial here – on the one hand, the experience of epidemics in which the political community indeed was at stake, and on the other hand the availability of a medical concept which helped to structure and shape a new aspect of political analysis.

Hence, Machiavelli and Campanella similarly advocated a kind of dynamic equilibrium of forces which, according to Michel Foucault, was not theorised until the treaties of Münster and Osnabrück, the basis for the Peace of Westphalia, were signed in 1648. In *Security, Territory, Population*, he argued for the existence of two species of theorists on reason of state. While the first category aimed at the maintenance of 'status' and the state, the second group, identified with 'practitioners' of reason of state, strove for expansion and the preservation of a dynamic equilibrium at the level of foreign relations.<sup>41</sup> The analysis of political dynamics undertaken by the 'practitioners' of reason of state was further supposed to be based on a 'modern' science, namely the physics of motion, as put forward by Leibniz:

So the dynamics of politics and the dynamics of physics are more or less contemporaneous. And we should see how all of this is connected through Leibniz, who is the general theorist of force as much from the historical-political point of view as from the point of view of physical science.<sup>42</sup>

But this classification ignored the existence of those theorists, like Machiavelli and Campanella, who advocated dynamic processes in domestic policies much earlier and evidently rejected the idea that motion was something noxious to the political sphere.<sup>43</sup> Both authors agreed that political dynamics were not only unavoidable, but also beneficial. Moreover, they believed that no governmental intervention was required to regulate or to balance these dynamics. Despite their mutual interest in the study of political motion, their analysis owed much less to the Leibnizian physics of motion than to physiological speculation about the nature of dynamics and conflict. Equally, Francesco Guicciardini, while rejecting outright Machiavelli's optimistic view of the constructive outcome of conflicting political constellations, did not refer to legal or physical arguments, but to medical

---

<sup>40</sup> Jones C., "Plague and Its Metaphors in Early Modern France", *Representations* 53 (1996) 112.

<sup>41</sup> Cf. Foucault M., *Security, Territory, Population. Lectures at the Collège de France, 1977–78* (New York etc.: 2007) 289.

<sup>42</sup> Cf. Foucault, *Security, Territory, Population* 295.

<sup>43</sup> The contrary opinion was held, for instance, by the Neapolitan lawyer Antonio Palazzo, another author on reason of state (*Discorso del governo e della ragion vera di stato*, 1606) discussed by Foucault.

ones. Machiavelli's praise of the beneficial effects of the antagonistic structure of the Roman republic was to him comparable to the appreciation of a disease thanks to the excellence of the remedy applied.<sup>44</sup>

*Controlled Dynamics. Francis Bacon's 'Royal and Political Motion'*

The interrelation between physiological and political concepts is noticeable not only in the works of Campanella, but also in those of his contemporary, the philosopher and statesman Francis Bacon. His essay *Of Seditions and Troubles* (1625), in particular, discussed political struggle and disharmony in terms of physiological dynamics.<sup>45</sup> Moreover, the Lord Chancellor's analysis of upheaval, conceived as extreme political dynamics, became consciously linked to his physiological ideas as put forward in his treatise on the physiology of aging, the *History of Life and Death* (*Historia vitae et mortis*, 1623). The *History of Life and Death* focused on the preservation and extension of human life, while the manifold measures proposed were mostly based on a theory of spirits. Similar topics were addressed in the earlier treatise *De vijs mortis* (1611), which was a stepping-stone to the natural philosophy implied in *History of Life and Death*.<sup>46</sup> Like Campanella, Bacon apparently had very little medical knowledge based on personal experience.<sup>47</sup> No wonder that physiology, as a 'speculative science which derives its conclusions from rational contemplation',<sup>48</sup> strongly appealed to Bacon. Apparently, strictly anatomical issues remained absent from the

<sup>44</sup> Guicciardini Francesco, *Considerazioni intorno ai discorsi del Machiavelli sopra la prima deca di Tito Livio*, in Guicciardini Francesco, *Opere inedite*, ed. Guicciardini P. – Guicciardini L. (Florence: 1857), vol. 1, 13.

<sup>45</sup> The essay already appeared in a manuscript written between 1607 and 1612, but was not included in the print edition of 1612. The edition of 1625 contained a substantially enlarged version. Cf. Spedding J. – Ellis R.L. – Heath D.D., "Edition of 1612", in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D. (London: 1858–1874), vol. VI, 1 (Hereafter cited as *Works*) 536.

<sup>46</sup> The manuscript of this treatise was only published in 1984. Cf. Rees G., "Introduction", in Bacon Francis, *The Oxford Francis Bacon*, ed. Rees G. (Oxford etc.: 2003), vol. VI (Hereafter cited as *OFB*) xxxi; Rees G. (assisted by Upton C.), *Francis Bacon's Natural Philosophy. A New Source* (Chalfont St. Giles: 1984).

<sup>47</sup> Practices of self-experimentation are difficult to assess, but they apparently existed, as Bacon nonchalantly reports a weird experiment by a 'certain gentleman who, in playful mood and out of curiosity, wanting to know what people suffered when they were hanged, hanged himself. The gentleman would have experienced death itself, had it not been for a friend who helped him back onto the stool from which he had jumped. Bacon Francis, *History of Life and Death* in Bacon Francis, *OFB*, ed. Rees G. (Oxford etc.: 2007), vol. XII, 341.

<sup>48</sup> Bylebyl, "Disputation and Description" 226.

medical writings of Bacon. An investigation into the interrelation between Bacon's political and medical thought also requires a closer look at the Lord Chancellor's physiological speculation itself, which is a part of his natural philosophy.<sup>49</sup>

His essay *Of Seditions and Troubles* is primarily concerned with the political techniques aimed at the preservation of states. Botero's distinction between means of extension and means of preservation of states – the latter being considered the most important – seems to be implicit here, as Bacon discussed the aspect of expansion elsewhere in the *Essays*, namely in *On the True Greatness of Kingdoms and Estates* (1625).<sup>50</sup> Although Bacon repudiated the optimistic view on self-regulation as put forward by Machiavelli and Campanella, he concurred with the idea that motion was as natural in states as it was in nature itself. Hence, its mere existence could not possibly endanger the persistence of states. As motion was again seen as resulting from a fundamental antagonistic pattern characterising political structures, Bacon explicitly approved of conflictual states in nature and equally agreed with Machiavelli on its constructive character in the political sphere. It was not discord that was regarded as the utmost evil in political life, but concord, or the unification of interests between antagonistic social and political factions, as this constituted a serious threat for any ruler:

When one of these is Discontent, the danger is not great, For Common People, are of slow Motion, if they be not excited, by the Greater Sort; And the Greater Sort are of small strength [...]. Then is the danger, when the Greater Sort doe but wait for the Troubling of the Water, amongst the Meaner, that then they may declare themselves.<sup>51</sup>

This was mostly a variation of a commonplace derived from the literature on reason of state, which maintained that the stability of the government could be enhanced by fostering disunity amongst the subjects. But the passage also revealed that Bacon, like Machiavelli, approved of the tense

---

<sup>49</sup> Rees, "Introduction" (see footnote 47) is a comprehensive account of the author's extensive research on Bacon's natural philosophy. See also Rees G., "Matter Theory: A Unifying Factor in Bacon's Natural Philosophy?", *Ambix* 24, 2 (1977) 110–125. For Bacon's theory of spirits Rees G., "Francis Bacon and *Spiritus Vitalis*", in Fattori M. – Bianchi M. (eds.), *Spiritus*. IV<sup>o</sup> Colloquio Internazionale. Roma, 7–9 gennaio 1983 (Rome: 1984) 265–281.

<sup>50</sup> Similarly to *Of Seditions and Troubles*, a first version of the essay existed already in 1612 and was printed under the title *Of the True Greatness of the Kingdom of Britain*. The version from 1625 is twice as long as the earlier draft. See Peltonen M., "Politics and Science: Francis Bacon and the True Greatness of States", *The Historical Journal* 35, 2 (1992) 284.

<sup>51</sup> Bacon Francis, "Of Seditions and Troubles", in Bacon, *Works*, vol. VI, 1, 411.

equilibrium of political forces in the sphere of domestic policies. Thus, in order to preserve a political equilibrium based on divergent interests, the ruler should not take sides:

Also, as Macciavel noteth well; when Princes, that ought to be Common parents, make themselves as a Party, and leane to a side, it is as a Boat that is overthrown, by uneven weight, on the one Side.<sup>52</sup>

This implied that the ruler had no part in the antagonistic pattern, but rather constituted a third party with a different, coordinative and regulatory function. By the introduction of a third party, Bacon challenged the Machiavellian and Campanellian concept of a dualistic and self-regulating dynamism. This new element functioned as a balance, evidently not between two static weights, but between two forces strongly opposed to each other. The standstill was only apparent because it was caused by the maximal resistance of two forces, as Bacon illustrated: 'if someone is pinned to the ground in a wrestling bout, and bound hand and foot, or held down otherwise, and yet with all his strength still struggles to get up, his resistance is no less because it gets him nowhere'.<sup>53</sup>

With regard to politics, Bacon approved of both motion and heat, but in contrast to Campanella, he insisted on their moderate application. Bacon equated political upheaval to the physiological state of feverish heat and considered them both dangerous: 'As for Discontentments, they are in the Politique Body, like to Humours in the Naturall, which are apt to gather a preternaturall Heat, and to Enflame'.<sup>54</sup> Clearly echoing Avicenna's hypothesis that fever was a kind of extraneous heat, Bacon pointed out the necessity of applying temperature regulation to the political sphere. Otherwise, the whole state ran the risk of burning down. Hence the Baconian warning to prevent reasons for upheaval, such as discontentment and widespread poverty, from emerging: 'For if there be the Fuell prepared, it is hard to tell, whence the Spark shall come, that shall set it on Fire'.<sup>55</sup> Bacon described seditions and civil wars quite consistently in terms of pathological states of heightened temperature and sharply distinguished this from healthy forms of excessive temperature, like those resulting from exercise. The healthy exercise Bacon had in mind was warfare against foreign

---

<sup>52</sup> Bacon, *Works*, vol. VI, 1, 408.

<sup>53</sup> Bacon Francis, *Novum Organum*, in Bacon Francis, *OFB*, ed. Rees G. (Oxford etc.: 2004), vol. XI, 417.

<sup>54</sup> Bacon, *Works*, vol. VI, 1, 409.

<sup>55</sup> Bacon, *Works*, vol. VI, 1, 408.

countries, as he asserted: 'No Body can be healthful without exercise, neither naturall body, nor politic [...]. A civil War indeed is like the heat of a fever; but a foreign war, is like the heat of exercise, and serveth to keep the body in health'.<sup>56</sup> Here, the Baconian speculations on bodily heat serve to justify an imperialist policy.

Obviously, with regard to fever, body temperature was not conceived as self-regulatory, at least not in political bodies. And this proclaimed necessity of temperature regulation derived directly from Bacon's physiological notions. In *History of Life and Death*, Bacon made explicit that fever was an extraneous form of heat which posed a threat to the *calor innatus*, or innate heat:

If the spirit endures an insult from another heat far stronger than its own it is dissipated and destroyed [...]. We see this in burning fevers where the heat of the putrefied humours surpasses the native heat to the point of extinguishing or dissipating it.<sup>57</sup>

It further became obvious that the generation of innate heat was supposed to be the task of the spirits, which were expected to perform the same functions in the physiological sphere as the ruler was to accomplish in the political arena. The theory of spirits put forward by Francis Bacon was not concerned only with the working of the spirits in living bodies, but equally with their relevance for cosmological, meteorological, mechanical and hydrodynamic phenomena. His undertaking therefore may be rightly called 'physiology' in the early modern sense, i.e. an investigation into the *physis* or nature of all things. The theory of spirits put forward by Francis Bacon diverged from the usual distinction into three kinds of spirits, as it asserted the existence of only two species, namely the *spiritus mortualis* and *spiritus vitalis*. While the first was inanimate and resided in all things in the cosmos, the second, animate, spirit was only found in living things. The *spiritus vitalis* provided animate bodies with two important qualities: as a kind of kinetic substance it endowed the body with the faculty of motion, and as a coordinative element it regulated motion and enabled interaction.

The vital spirits were held responsible for all dynamic processes in the living body, as Bacon pointed out: 'The spirits are the craftsmen and

---

<sup>56</sup> Bacon Francis, "Of the True Greatness of Kingdoms and Estates", in Bacon, *Works* VI, 1, 411.

<sup>57</sup> Bacon, *History of Life and Death*, OFB, vol. XII, 333.



workers who do everything that happens in the body'.<sup>58</sup> This meant that they not should work like maniacs, but rather should maintain a steady rhythm at work – 'not twitchy or uneven in their motion'.<sup>59</sup> Rapid motion was to be avoided because it was supposed to be accompanied by an increase in body temperature which was explicitly thought to be noxious, as heat transformed diligent spirits into voracious beasts which consumed the body's resources at a fast pace: 'For these give the spirits heat which is not workmanlike but rapacious'.<sup>60</sup> After all, fever was perceived as an irregular form of increase in body temperature with damaging consequences for physiological dynamics.

Spirits were further supposed to act as a prime mover in the sphere of human physiology, giving a strong initial impetus which was conveyed successively throughout the body: 'The nature of the spirits is as it were the chief cog which keeps all the other cogs in the human body turning'.<sup>61</sup> Exactly the same idea was voiced by Bacon with regard to the political sphere – here, the strongest impetus had to emanate from the ruler and should not be surpassed by the motion of any other person in the state:

For the Motions of the greatest persons, in a Government, ought to be, as the Motion of the Planets, under Primum Mobile; [...] which is, That Every of them, is carried swiftly, by the Highest Motion, and softly by their own Motion.<sup>62</sup>

In order to demonstrate the necessity of a hierarchical sequence of motions in the political sphere, Bacon introduced an astronomical theory derived from Alpetragius, an Arabic Aristotelian from the twelfth century. Alpetragius had explained celestial motion as a result of the powerful initial impetus of the prime mover which was passed on from planetary sphere to sphere, a process which was accompanied by a gradual decrease of speed. This led to the assumption of a proportional ratio between position in space and respective speed, or, in other words, the lower the sphere and planet, the slower its periodic motion. As the theory was strongly opposed to astronomical observation and the longstanding knowledge of planetary cycles, by the early seventeenth century it was not taken seriously by anyone but Francis Bacon. Although Bacon's fame was rooted

---

<sup>58</sup> Bacon, *History of Life and Death*, OFB, vol. XII, 245.

<sup>59</sup> Bacon, *History of Life and Death*, OFB, vol. XII, 247.

<sup>60</sup> Bacon, *History of Life and Death*, OFB, vol. XII, 259.

<sup>61</sup> Bacon, *History of Life and Death*, OFB, vol. XII, 365.

<sup>62</sup> Bacon, *Works*, vol. VI, 1, 408.

in his proposal of a full programme and method for the constitution of a new body of scientific knowledge, as put forward in *The Advancement of Learning* (1605) and *Novum Organum* (1620), he remained opposed to many important contributions to the sciences during his lifetime, such as Copernican astronomy<sup>63</sup> or Harveian physiology. The latter is even more striking if one takes into account that Bacon could have obtained information at first hand from William Harvey, who from 1618 onwards also ministered to Bacon as a physician.

The Alpetragian astronomy held that motion was distributed among the planets hierarchically. Bacon applied this top-down model to the political order and concluded that an over-proportional activity by any politician would result in utter confusion, and asserted: 'And therefore, when great Ones, in their owne particular Motion, move violently, [...] it is a Signe, the Orbs are out of Frame'.<sup>64</sup> Evidently, Bacon did not advocate a static state, but a dynamic one, as long as it were in due proportion to its position in a highly ordered cosmic and political hierarchy. In contrast to Campanella, Bacon tended to analyse the political scenery from a bird's eye view. His identification with the ruler's perspective very likely had to do with his own elevated political rank. His career as a member of parliament, which had originally progressed slowly, began to prosper notably with the succession of James I to the crown in 1603 and culminated in his appointment to the position of Lord Chancellor in 1618. Although Bacon later fell into disgrace when he was charged with corruption, he never relinquished his claims to the highest political ranks.<sup>65</sup> Some of his other political writings also displayed the tendency to view politics from the ruler's perspective.<sup>66</sup> Two apologetic texts dealt with Bacon's role in real seditions and troubles, namely with Bacon's responsibility as legal counsellor of Elizabeth I in the lawsuit against his former patron and political ally, Robert Devereux, Earl of Essex, who was accused of high treason and was executed in 1601. *A Declaration of the Practises and Treasons Attempted and Committed by Robert, late Earl of Essex and his Complices* (1601) functioned as a defence against the public accusation of disloyalty. In *Sir Francis Bacon His Apol-*

<sup>63</sup> Cf. Rees, "Introduction" xl.

<sup>64</sup> Bacon, *Works*, vol. VI, 1, 408.

<sup>65</sup> Peltonen M., "Bacon's Political Philosophy", in Peltonen M. (ed.) *The Cambridge Companion to Bacon* (Cambridge etc.: 1996) 283.

<sup>66</sup> Most notably *The History of the Reign of King Henry the Seventh* (1622).

ogy, in *Certain Imputations Concerning the Late Earl of Essex* (1604),<sup>67</sup> a similar strategy was adopted, thus maintaining that what might look like disloyalty and ingratitude towards Bacon's former supporter, could, when seen from a different angle, take on the appearance of loyalty towards royal interests, and therefore to the state. With regard to the initiation of motion, the emphasis that Bacon placed on the highest political sphere perfectly agreed with his physiological speculations which encompassed the working of the spirits at all levels of nature. Spirits, both vital and mortal, constituted the unifying element, as their activity brought about the dynamic principle that permeated all spheres.

From this perspective, the ruler's activity came to be regarded as the central or universal motion that subsequently affected all parts of the state. This centralised force had its equivalent in the working of the vital spirits at the physiological level. Hence, Bacon's physiology and political reflection, like Campanella's, displayed a generalising tendency in binding together the bewildering multitude of forces, faculties and virtues that were supposed to be at work in bodily processes. Despite this universalising tendency, the ruler was not expected to be the sole dynamic part, as his motion concurred with the feebler local motion of other statesmen. In fact, Bacon did not expect the whole state to remain motionless except for the monarch, but took the local motion into account, as long as this motion remained within limits. This therefore led to the second important function of the ruler, which was to regulate and coordinate motions performed by other political players. This regulative function, as evoked in Bacon's suggestion that the ruler should avoid taking sides and should instead try to balance existing tensions, equally corresponded to the activity of the spirits in the realm of physiology. In fact, the vital spirits also provided a kind of central motion, which sometimes encountered the opposition of a weaker local motion from the organs. The idea of local motion, both with regard to physics and physiology, had a longstanding tradition that went back at least as far as Aristotle.

Bacon further introduced political thought into this physiological reasoning, as he came to analogise the relationship between local and central motion, and the political distinction between public and private matters. Central motion performed by the vital spirits should prevail over local

---

<sup>67</sup> Both texts adopted the genre of letters to two noble allies of the Essex party, but they were clearly meant to circulate beyond their official addressees. They failed completely in their intention, as the rumours concerning Bacon's ambiguous role in the Essex trial persisted.

ones, like public interests prevail over private needs: 'appetites which act for private interest seldom prevail over more public ones, except where small quantities are involved; which is not the case, alas, in civil affairs'.<sup>68</sup> The existence of different kinds of motion, diverging with regard to their intensity, seemed to necessitate a coordinative device which Bacon supposed to be indispensable for the most basic physiological functions, such as digestion and assimilation which were attributed primarily to the working of the spirits. They seemed 'to act by perceptio, mere reactions to local stimuli, but these reactions [were] co-ordinated by the vital spirit'.<sup>69</sup> As a consequence, the vital spirits performed a supervising function over the most essential and persistent physiological processes, which, like temperature regulation, were not thought to work autonomously. Bacon furthermore explicitly identified this important function that he saw at work in physiological processes as a governmental technique. After all, the coordinative function figured prominently under the title of the 'Royal or Political Motion' in the Baconian classification of nineteen simple motions, as listed in the *Novum Organum*.<sup>70</sup> It was defined as a universal force,

by which the parts governing or maintaining in ascendancy in any body curb, tame, suppress, and order the other parts, and compel them to unite, separate, stand still, move, and assemble, not according to their own desires but to the well-being of the governing part, and that the ruling part exercises a kind of Government or Political Power over the subject parts.<sup>71</sup>

The performance of this kind of motion was primarily the task of the vital spirits and was conceived as an excellent skill which characterised only the most refined substances: 'Nor is this motion a property of spirits alone, though in most bodies the spirits have the upper hand on account of their swift and penetrating motion'.<sup>72</sup> From this naturalisation of Bacon's political ideas it may be deduced that he identified the ruler's task with the coordination, organisation and also the suppression of the subjected forces; a task which, according to him, served the common good. At the political level, rulers were doubtlessly endowed with coordinative faculties, but

---

<sup>68</sup> Bacon, *Novum Organum*, OFB, vol. XI, 409. The 'appetites' seem reminiscent of Machiavelli's diction.

<sup>69</sup> Rees, "Introduction" lviii.

<sup>70</sup> Cf. Bacon, *Novum Organum*, OFB XI, 384–417. We would rather call them forces or faculties. Like Aristotle, Bacon abstained from a definition of motion as a single change in spatial position but included many processes which implied significant changes in material quality.

<sup>71</sup> Bacon, *Novum Organum*, OFB, vol. XI, 409.

<sup>72</sup> Bacon, *Novum Organum*, OFB, vol. XI, 409.

Bacon nonetheless suggested that it was wiser to rely on auxiliary military support: 'let Princes, against all Events, not be without some great Person, one, or rather more, of Military Valour neere unto them, for the Repression of Seditions, in their beginnings'.<sup>73</sup> By ascribing governmental practices of control and regulation to the vital spirit, Bacon contextualised the assumed activity of the vital spirit in natural bodies with the execution of governmental techniques by the ruler in the political sphere. In other words, the ruler was supposed to act on the political ground in the same way as the vital spirit in the sphere of physiology.

Bacon was not only well acquainted with the political thought of Machiavelli and reason of state, but as a statesman was also familiar with its practice.<sup>74</sup> Therefore, he surely merits inclusion into the category of 'practitioners' of reason of state as proposed by Foucault. But neither the Baconian reflection on dynamics and forces, nor the ideas of Campanella, owed as much to the physics of Leibniz or the Leibnizian field of forces as Foucault suggested. It seems that the interrelation between the theorisation of political and mechanical dynamics preceded Leibnizian physics and the Peace of Westphalia, and that Foucault's hypothesis of the relationship therefore needs to be historicised. Both Campanella and Bacon, instead of relying on the physics of motion, seem to have derived their ideas on political dynamics primarily from physiological concepts of motion which were thought to apply to a multitude of natural phenomena and were not restricted to living bodies. Physiological processes, such as the generation of body motion and heat and the communication between bodily parts, obviously provided an important model for the description of dynamics and interaction in the political sphere – and vice versa. Both authors seem to use physiological concepts in a consistent way, which is most obvious in their discussion of fever. Bacon's subtle distinction between innate heat, preternatural heat and bodily heat resulting from exercise in the debate concerning seditions indicates that this is evoking not an everyday notion of fever, but a medically consistent one. Hence, medical language contributed in structuring the debate on seditions and other forms of political unrest and in providing the conceptual frame within which newly emerging topics, like that of state preservation, could begin to be discussed. In this sense, the frequent reference to physiology

---

<sup>73</sup> Bacon, *Works*, vol. VI, 1, 412.

<sup>74</sup> For Bacon's indebtedness to Machiavelli see Peltonen, "Politics and Science: Francis Bacon and the True Greatness of States" 279.

in early modern political thought may be understood as an important contribution to the process of the medicalisation of governmental techniques, a process by which medical practices such as physiology, diagnostics and therapy came to be regarded as valuable instruments of political analysis and governmental action. The application of medical practices to political analysis further constitutes an early attempt to establish a science of politics on the basis of a natural science; namely, medicine.

### Selective bibliography

- AMABILE L., *Fra Tommaso Campanella. La sua congiura, i suoi processi e la sua pazzia*, 3 vols. (Naples: 1882).
- BACON FRANCIS, *History of Life and Death* in Bacon Francis, *The Oxford Francis Bacon*, ed. Rees G., 15 vols. (Oxford etc.: 2007), vol. XII.
- , *Novum Organum*, in Bacon Francis, *The Oxford Francis Bacon*, ed. Rees G., 15 vols. (Oxford etc.: 2004), vol. XI.
- , “Of Seditions and Troubles”, in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874), vol. VI, 1, 406–412.
- , “Of the True Greatness of Kingdoms and Estates”, in Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874), vol. VI, 1, 444–452.
- BOTERO GIOVANNI, *Della ragion di stato. Con tre libri delle cause della grandezza delle città, due aggiunte e un discorso sulla popolazione di Roma*, ed. Firpo L. (Turin: 1948)
- BYLEBYL J.J., “Disputation and Description in the Renaissance Pulse Controversy”, in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 223–245.
- CAMPANELLA TOMMASO, *Del senso delle cose e della magia*, ed. Ernst G. (Rome-Bari: 2007).
- , *Epilogo magno (Fisiologia italiana)*, ed. Ottaviano C. (Rome: 1939).
- , *Medicinalium iuxta propria principia libri septem* (Lyons, Pillehotte for Caffin and Plignard: 1635).
- , *Secondo schema delle difese di Fra Tommaso Campanella. Articoli profetali da inserire nelle difese di Campanella*, in Firpo L., *Il supplizio di Tommaso Campanella. Narrazioni – Documenti – Verbalì delle torture* (Rome: 1985) 130–175.
- COHEN B.L., “Harrington and Harvey: A Theory of the State based on the New Physiology”, *Journal of the History of Ideas* 55, 2 (1994) 187–210.
- COUZINET M.-D., “Notes sur les Medicinalia de Tommaso Campanella”, *Nuncius* 13 (1998) 39–67.
- DELL’ANNA G., *Dies critici. La teoria della ciclicità delle patologie nel XIV secolo*, 2 vols. (Lecce: 1999).
- ERNST G., *Tommaso Campanella. Il libro e il corpo della natura* (Rome-Bari: 2002).
- FIRPO L., “Introduzione”, in Campanella Tommaso, *La Città del Sole*, ed. Firpo L., new ed. Ernst G. – Salvetti Firpo L. (Rome-Bari: 1997) ix–xlvii.
- FOUCAULT M., *Security, Territory, Population. Lectures at the Collège de France, 1977–78* (New York etc.: 2007).
- GIGLIONI G., “Healing and Belief in Tommaso Campanella’s Philosophy”, *Intellectual History Review* 17 (2007) 225–238.
- , “Immaginazione, spiriti e generazione: La teoria del concepimento nella *Philosophia sensibus demonstrata*”, *Bruniana & Campanelliana* 4 (1998) 37–57.
- , “La Medicina di Tommaso Campanella tra metafisica e cultura popolare”, in Ernst G. – Fiorani C. (eds.), *Laboratorio Campanella. Biografia – Contesti – Iniziative in Corso*. Atti del Convegno della Fondazione Camillo Caetani. Roma, 19–20 ottobre 2006 (Rome: 2007) 177–195.
- GUICCIARDINI FRANCESCO, *Considerazioni intorno ai discorsi del Machiavelli sopra la prima decada di Tito Livio*, in Guicciardini Francesco, *Opere inedite*, eds. Guicciardini P. – Guicciardini L., 10 vols. (Florence: 1857), vol. 1.
- HALE D.G., *The Body Politic. A Political Metaphor in Renaissance English Literature* (The Hague-Paris: 1971).
- HEADLEY J.M., *Tommaso Campanella and the Transformation of the World* (Princeton, NJ: 1997).



- HILL C., "William Harvey and the Idea of Monarchy", *Past and Present* 27 (1964) 54–72.
- JONES C., "Plague and Its Metaphors in Early Modern France", *Representations* 53 (1996) 97–127.
- KLIER G., *Die drei Geister des Menschen. Die sogenannte Spirituslehre in der Physiologie der Frühen Neuzeit* (Stuttgart: 2002).
- LEON L.R., "Cytokine Regulation of Fever: Studies Using Gene Knockout Mice", *Journal of Applied Physiology* 92, 6 (2002) 2648–2655.
- MACHIAVELLI NICCOLÒ, *Discourses on Livy*, trs. H.C. Mansfield – N. Tarcov (Chicago-London: 1996).
- MÖNNICH M.W., *Tommaso Campanella. Sein Beitrag zur Medizin und Pharmazie der Renaissance* (Stuttgart: 1990).
- NEUBURGER M., *Die Lehre von der Heilkraft der Natur im Wandel der Zeiten* (Stuttgart: 1926).
- NUTTON V., "Physiologia, From Galen to Jacob Bording", this volume 27–40.
- OTTAVIANO C., "Prefazione", in Campanella Tommaso, *Epilogo magno (Fisiologia italiana)*, ed. Ottaviano C. (Rome: 1939) 5–177.
- PELTONEN M., "Bacon's Political Philosophy", in Peltonen M. (ed.) *The Cambridge Companion to Bacon* (Cambridge etc.: 1996) 283–310.
- , "Politics and Science: Francis Bacon and the True Greatness of States", *The Historical Journal* 35, 2 (1992) 279–305.
- RATHER L.J. – FRERICHS J.B., "On the Use of the Military Metaphor in Western Medical Literature: The Bellum contra Morborum of Thomas Campanella (1568–1639)", *Clio Medica* 7 (1972) 201–208.
- REES G., "Introduction", in Bacon Francis, *The Oxford Francis Bacon*, ed. Rees G., 15 vols. (Oxford etc.: 2003), vol. VI, xvii–cx.
- , "Francis Bacon and *Spiritus Vitalis*", in Fattori M. – Bianchi M. (eds.), *Spiritus*. IV<sup>o</sup> Colloquio Internazionale. Roma, 7–9 gennaio 1983 (Rome: 1984) 265–281.
- , (assisted by Upton C.) *Francis Bacon's Natural Philosophy. A New Source* (Chalfont St. Giles: 1984).
- , "Matter Theory: A Unifying Factor in Bacon's Natural Philosophy?", *Ambix* 24, 2 (1977) 110–125.
- VILLARI R., *The Revolt of Naples* (Cambridge etc.: 1993).

# HERMAN BOERHAAVE'S NEUROLOGY AND THE UNCHANGING NATURE OF PHYSIOLOGY

Rina Knoeff

## *Summary*

In the early eighteenth century Herman Boerhaave was one of the most important medical teachers. It has been argued that his success was largely due to the fact that he managed to incorporate modern discoveries into the Hippocratic medicine taught at the university. The synthesis of ancient ideas and modern discoveries is clearly visible in Boerhaave's physiology of the brain and nerves. This essay argues that (1) in Boerhaave's physiology of the brain and nerves the ancients and early-moderns were not opposed but offered complementary explanations, whereby it must be remarked that ancient concepts (for example, the *sensorium commune*) often received new meanings; and (2) that Boerhaave's neurological ideas ideally fitted the old, and essentially philosophical, discipline of physiology and that, for this reason, we cannot in the case of Boerhaave's neurology speak of a 'changing concept of physiology' in the Early Modern period.

In order to teach his pupils about the business of physiology, the Dutch medical teacher Herman Boerhaave (1668–1738) illustrated his lectures with a case study. He told his students the story of the youngest daughter of a Dutchman living in America. The girl seemingly died from an epidemic fever. A slave, originally from Angola, knew how to 'restore the dear soul to life'. He chewed upon some very strong plants and spat them into the nose of the girl while simultaneously opening her mouth. Boerhaave stated that in so doing the slave agitated the *sensorium commune* in order to 'excite them [the nerves] to motion, make the heart contract, and propel forward its blood'. After repeating the action several times, the girl was brought back to life and 'recovered' (although even Boerhaave wondered what kind of life remained as the girl seemed 'to be in a sort of limbo between life and death').<sup>1</sup>

---

<sup>1</sup> Boerhaave Herman, *Dr. Boerhaave's Academical Lectures on the Theory of Physic. Being a Genuine Translation of His Institutes and Explanatory Comment* (London, W. Innys: 1751), vol. I, 91–92.

In this curious story about a miraculous recovery to life, Boerhaave explicitly linked physiology – which he defined as ‘the sum or aggregate of all the actions performed in the *living* body’ – to the working of the nervous system.<sup>2</sup> It is not surprising, therefore, that Boerhaave mentioned not the heart, but the brain, as the central organ of the body. Boerhaave was particularly interested in the *sensorium commune* or ‘that which moves the nerves’ as the central organ causing the body’s life and motion. After all, in the case of the ‘dead’ girl, the juices of the plant agitated the *sensorium commune* and the nerves even before the heart and lungs were affected. Also, Boerhaave’s insistence on the brain as the most potent organ of the body, which he borrowed from the Hippocratic writings, such as the treatise *On the Sacred Disease*, seamlessly fitted the new Harveian physiology of circulation.

In this essay I argue firstly that, in Boerhaave’s physiology of the brain and nerves, the ancients and early-moderns were not opposed but offered complementary explanations; and secondly that Boerhaave’s neurological ideas perfectly fitted the ancient discipline of physiology and that, for this reason, at least in the case of Boerhaave’s neurology, we cannot speak of a ‘changing concept of physiology’ in the Early Modern period. But before arguing these points I first discuss how Boerhaave’s neurology was embedded in early modern physiology.

### *Old physiology and Boerhaave’s neurology*

Andrew Cunningham has recently argued that the ‘old physiology’ crucially depended on natural philosophy:

The fundamental meaning of ‘physiology’ within medicine depended directly on its wider basic meaning as the inquiry into the natures of things in general. That is to say, the medics’ physiology dealt with the nature of a *particular* natural thing, the human (or animal) body. Physiology discussed how it is, how it works, and why [...] physiology was a changing and controversial discipline over the years because it was constantly affected by the application to it of innovations in thinking in the discipline of natural philosophy, of which it was a subsidiary part. When explanations in natural philosophy changed, so explanation in physiology also changed.<sup>3</sup>

<sup>2</sup> Boerhaave, *Academical Lectures*, vol. I, 90–91. My italics.

<sup>3</sup> Cunningham A., “The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen”, *Studies in History and*

By stressing that the old physiology was a philosophical discipline, Cunningham firmly denies that physiology was an experimental science in the modern sense of the word. In Cunningham's view the old physiology (as opposed to the new scientific discipline of experimental physiology introduced by Claude Bernard in the early nineteenth century) had very little to do with experimental practice. It was a 'thinking and talking discipline – a discourse', which meant that 'it dealt in reasoning, not in empirical phenomena. It sought causes: "whys?" not just "whats?" and "hows?"'. Its object was the nature of the healthy body and it depended on conceptual reasoning (*i.e.* not on empirical or visual demonstration).

This is not to deny that early modern natural philosophers were busy experimenting. Yet, whatever they were doing, they were not performing *physiological* experiments – for physiology was a 'theoretical knowledge', rather than an 'experimental' discipline. Again I follow the argument of Andrew Cunningham in stating that experiments made on living and dead animal bodies were *anatomical* and that until the period around 1800 it was anatomy (and not physiology) which was considered the senior discipline in the investigation of the phenomena of life. Thus, for the early moderns, anatomy was always 'the primary discipline, not in the sense that it had been created first, but because physiology usually took its sensory information from anatomy, including its experimental evidence'.<sup>4</sup> Anatomical experiments did not ask 'why' questions (as was usual in physiology and natural philosophy) but they asked 'what?', 'how?', and 'whether?' This goes for the experiments of Dutch natural philosophers like Jan Swammerdam and Reinier de Graaf as well as for the experiments of William Harvey and the so called 'Oxford physiologists'.<sup>5</sup> Although of course their discoveries had important physiological implications, their experiments were anatomical. They were mainly interested in the structure and action of the human or animal body. They were, however, far less interested in physiological speculation about final causality. After all, this

---

*Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 641. See also Cunningham A., *The Anatomist Anatomis'd. An Experimental Discipline in Enlightenment Europe* (Aldershot: 2010).

<sup>4</sup> Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 52.

<sup>5</sup> The term 'Oxford physiologists' was introduced by Robert Frank in his *Harvey and the Oxford Physiologists. A Study of Scientific Ideas* (Berkeley: 1980).

was the domain of the physiologists, and removed from their anatomical practices.

Boerhaave, unlike Swammerdam, de Graaf and Harvey, was no anatomist. Even more, contrary to what historians of medicine have always argued, medical practices were not Boerhaave's thing.<sup>6</sup> He did not do anatomical experiments himself – Albrecht von Haller states that he hardly ever turned up when a public anatomical demonstration took place – and, except in the final years of his academic career, he hardly ever did any bedside teaching.<sup>7</sup> In Boerhaave's time the beds in the *Caecilia* hospital assigned to the *collegium medico-practicum* were empty most of the time.<sup>8</sup> Indeed, Boerhaave mainly gave medical advice to patients in his extended private correspondence, but it is obvious that these paper patients had little to do with clinical instruction. It is doubtful whether students often *observed* Boerhaave treating patients. Even the lectures on nervous diseases, for which Boerhaave took his students to the hospital, did not contain discussions of individual patients. Boerhaave's clinical lectures were clearly directed at a theoretical understanding of the physiology of the nervous system and its diseases much more than at the treatment of concrete medical cases. Boerhaave revealed his aversion to practical medicine in a letter to his friend Joannes Baptista Bassand where he wrote that he hated his 'tiresome' medical practice.<sup>9</sup> To the chagrin of some of his colleagues, Boerhaave's medicine – including his iatrochemical experiments – was 'armchair medicine'. It depended on conceptual reasoning; it was a

---

<sup>6</sup> For accounts praising Boerhaave's clinical efforts see for instance: Lindeboom G.A., *Herman Boerhaave. The Man and his Work* (Leiden: 1968) 283–297; Risse G.B., "Clinical Instruction in Hospitals: The Boerhaavian Tradition in Leyden, Edinburgh, Vienna and Pavia", *Clinical Teaching Past and Present. Clio Medica* 21 (1987–1988) 1–19.

<sup>7</sup> For Haller commenting on Boerhaave's attendance at public anatomical demonstrations see: Lindeboom G.A., (ed.) *Haller in Holland. Het Dagboek van Albrecht von Haller van zijn Verblijf in Holland 1725–1727* (Delft: 1958) 61.

<sup>8</sup> Harm Beukers has looked at hospital admissions in Boerhaave's time. See his "Clinical Teaching in Leiden from its Beginning until the End of the Eighteenth Century", *Clinical Teaching Past and Present. Clio Medica* 21 (1987–1988) 139–152. See also Knoeff R., "Boerhaave at Leiden: *Communis Europae praeceptor*", in Arrizabalaga J. – Cunningham A. – Grell O.P. (eds.), *Centres of Medical Excellence? Medical Travel and Education in Europe, 1500–1789* (Aldershot: 2010) 269–286. Other historians of medicine have also cast doubt on the hero-story. See for instance: Daremberg C., *Histoire des Sciences Médicinales* (Paris: 1870), vol. 2, 890; Ultee M., "The Politics of Professional Appointment at Leiden, 1709", *Journal for the History of Medicine and Allied Sciences* 9 (1990) 167–194; Cook H.J., "Boerhaave and the Flight from Reason in Medicine", *Bulletin for the History of Medicine* 74 (2000) 221–240.

<sup>9</sup> Boerhaave to Bassand, 6 May 1723 in Lindeboom G.A. (ed.), *Boerhaave's Correspondence* (Leiden: 1964), vol. 2, 199.

medical system which had little to do with the discussion and treatment of individual cases.<sup>10</sup> Boerhaave, in other words, was a classic example of an 'old physiologist', taking the results of anatomical experiments (without doing them himself) for the purpose of physiological speculation.

The philosophical nature of Boerhaave's medicine is immediately visible in his description of physiology, which he defined as the first general branch of physic aimed at

[...] demonstrating the several parts of the human body, with their mechanism and actions; together with the doctrine of life, health, and their several effects, *which result from the mechanism and actions of the parts*. The objects of this branch have usually been denominated 'Res naturales', things natural or according to nature.<sup>11</sup>

In his writings, Boerhaave made a clear distinction between the 'theoretical' nature of physiology and anatomy. Whenever Boerhaave spoke about anatomy, he talked about the mechanisms and actions of the parts (or the 'whats?' and the 'hows?') and he argued that 'there is no room to doubt in anatomy, so far as it regards the structure, situation, and connexion, of the several parts'. Yet he considered anatomy (as well as the experimental disciplines of chemistry and mechanics) only the beginning of physic, for after establishing the anatomical 'facts' a physician 'ought to furnish himself with and *reason from*, such things as are demonstrated to be true in anatomy, chemistry and mechanics, with natural and experimental philosophy, provided he confines his reasoning within the bounds of truth and simple experiment'.<sup>12</sup> Boerhaave's physiology, in other words, was *not* experimentation. It was based on proper reasoning or 'a strict consideration of latent causes concealed from the senses'.<sup>13</sup>

Neurology, I argue, was a crucial part of Boerhaave's physiology. Without understanding Boerhaave's interest in nervous diseases it is impossible to understand the nature of Boerhaave's physiology taught in the last decades of his medical career.<sup>14</sup> Even though neurology did not play an important part in the *Institutiones medicae* of 1708, Boerhaave already

<sup>10</sup> Frederik Ruysch was particularly annoyed about Boerhaave's armchair medicine. See Knoeff R., "Chemistry, Mechanics and the Making of Anatomical Knowledge: Boerhaave vs. Ruysch on the Nature of the Glands", *Ambix* 53 (2006) 201–219.

<sup>11</sup> Boerhaave, *Academical Lectures*, vol. I, 77. My italics.

<sup>12</sup> Boerhaave, *Academical Lectures*, vol. I, 74.

<sup>13</sup> Boerhaave, *Academical Lectures*, vol. I, 57.

<sup>14</sup> In Boerhaave's medical career he adopted at least three different approaches. For a very short time, at the beginning of his career he adopted a Cartesian mechanism, after which he was very much attracted to Newtonianism. At the end of his career, however, he

argued as part of his definition of physiology that 'life' depends on the 'condition of the several fluid and solid parts of the body, which is absolutely necessary to maintain the mutual commerce between that and the mind'.<sup>15</sup> Boerhaave's physiology, in other words, was ultimately about neurology, as a healthy functioning of the nervous system would sustain the 'commerce' between the mind and the body. When his *Institutiones medicae* went to press, Boerhaave had already become sceptical of adopting the mechanical method in medicine (even though he had fervently defended this point in his 1703 oration on the use of the mechanical method in medicine).<sup>16</sup> Boerhaave became convinced that mechanics alone could not account for the nature of change – specifically, it could not explain the hidden causes and effects of motion that govern the body. Instead of formulating mechanical laws, Boerhaave started emphasising the structure and working of the smallest particles of matter and the powers peculiar to every part of the body.

Boerhaave's interest in the nervous system increased after 1709, and was a logical consequence of his new concern for the physiological processes in the smallest vessels of the body. At this time Boerhaave moved away from the traditional attention to the nature of the relatively large globules of the blood, and instead began investigating the smallest vessels and fluids of the nervous system. He considered the nervous system of the utmost importance in the explanation of motion and nutrition. With respect to nutrition, he argued that it chiefly happens in the smallest vessels of the nerves, with the nervous juice, which is the most subtle humour prepared from the serum of the blood, feeding the solid parts. In his 1715 oration on the achievement of certainty in physics (in which he paradoxically concluded that it is impossible ever to achieve certainty!), Boerhaave argued that we cannot even understand the nature of a single hair, if we know nothing about the disposition of the nerve.<sup>17</sup> During the last years of his teaching, from 1730 until 1735, Boerhaave lectured almost exclusively

---

devoted more and more attention to the individual powers of 'living things'. See Knoeff R., *Herman Boerhaave (1668–1738). Calvinist Chemist and Physician* (Amsterdam: 2002), ch. 4.

<sup>15</sup> Boerhaave, *Academical Lectures*, vol. I, 90–91.

<sup>16</sup> Boerhaave promoted the mechanical method in medicine in his 1703 oration *De usu ratiocinii mechanici in medicina*. Historians of medicine have often represented this early oration as the credo of Boerhaave's medicine, which led them away from Boerhaave's later medicine, which was totally different.

<sup>17</sup> Boerhaave Herman, *Sermo academicus de comparando certo in physicis* (Leiden: 1715), translated in Kegel-Brinkgreve E. – Luyendijk-Elshout A., *Boerhaave's Orations* (Leiden: 1983) 172.



on nervous diseases.<sup>18</sup> In his last oration, delivered in 1731 upon resigning his post as *Rector Magnificus*, he emphasised the importance of understanding the nervous system. He stated:

The Philosopher proclaims that the heart is the most important part of the body, and credulous popular opinion does not hesitate to echo this authoritative statement. As if the heart's power did not depend upon the nerves, upon the great arteries, and on the veins entering it!<sup>19</sup>

Boerhaave considered the topic so important that he even took his students to the hospital in order to illustrate his lectures on nervous diseases. And, as I have argued above, the fact that he undertook clinical instruction was truly exceptional.<sup>20</sup>

Boerhaave's neurology was a combination of classical (particularly Hippocratic) learning and the new natural philosophy. When starting his lectures, Boerhaave stated that hardly any medical teacher would consider the nervous diseases. In nevertheless tackling this extremely difficult topic, Boerhaave rhetorically presented himself as a new Hippocrates; he considered Hippocrates' views on the brain and nerves (and particularly the Hippocratic treatise *On the Sacred Disease*) as the basis of early modern neurology. Similarly, Boerhaave's ideas on sensation and motion laid the basis of later theories of sensibility and irritability. Furthermore, not only were both the treatises of Hippocrates and the lectures of Boerhaave pioneering works, but Boerhaave also followed the Hippocratic insistence on the brain as the seat of reason, sensation and motion – which he most likely borrowed from *On the Sacred Disease* – rather than the heart or diaphragm, as was argued in Aristotelian philosophy.<sup>21</sup> Hippocrates maintained that 'the diseases which attack the brain are the most acute, most serious and most fatal, and the hardest problem in diagnosis for the unskilled physician'.<sup>22</sup> Boerhaave likewise believed that the physiology of the nerves and brain was about the nature and working of the most

---

<sup>18</sup> Boerhaave's lectures on the nervous diseases have been translated and edited by B.P.M. Schulte in his *Herman Boerhaave praelectiones de morbis nervorum 1730–1735* (Leiden: 1959).

<sup>19</sup> Boerhaave Herman, *De honore medici, servitute* (Leiden: 1731), translated in Kegel-Brinkgreve E. – Luyendijk-Elshout A., *Boerhaave's Orations* 251. The Philosopher mentioned was of course Aristotle.

<sup>20</sup> As pointed out before, the clinical lectures were directed towards understanding the physiology of the nervous system rather than the treatment of concrete medical cases.

<sup>21</sup> Hippocrates, *The Sacred Disease*: tr. Lloyd G.E.R., *Hippocratic Writings* (Harmondsworth: 1983) 250.

<sup>22</sup> Hippocrates in Lloyd, *Hippocratic Writings* 251.

hidden parts of the body and therefore about the most hidden causes of sensation and motion in the body. For this reason he considered the nervous system not only one of the most difficult areas of research but also one of the most momentous, because it touched upon the immaterial and divine origin of life.

But Boerhaave's neurology was also rooted in new anatomical discoveries. He argued, after Malpighi, that the *encephalon* and *spinal medulla* are the first organs formed in the embryo, from which all other organs originate, so that 'we may believe that almost the whole mass of the solid parts in the body are complicated and made up with nervous filaments'.<sup>23</sup> Taking on board Harvey's ideas on circulation, Boerhaave further argued that life originates and is preserved because the nervous juices, excreted by the brain, circulate (like the blood and lymph) throughout the whole body. Its particles are so tiny that they reach 'every individual point or solid particle throughout the whole body'.<sup>24</sup> Boerhaave's student, Albrecht von Haller, later elaborated on this argument. He maintained that a physiologist must begin by explaining the forces 'through which the forms of things received by the senses are presented to the soul; through which the muscles, which are governed by the commands of the mind, in turn have strength'. Physiology, in von Haller's view, was about the 'movements by which the animated machine is activated'. Physiology, he said, is *Anatomia animata*.<sup>25</sup>

### *Sensorium commune*

In his series of lectures on nervous diseases Boerhaave treated the diseases of the brain and nerves as extremely serious medical conditions and therefore most worthy of medical attention. He argued that nervous diseases, like no other disease, affected the wellbeing of man as a whole – it was, after all, commonly known that a disease of the brain usually affected all the parts of the body. The most serious of the serious nervous diseases, Boerhaave stated, were the diseases which affected the *sensorium commune*, such as apoplexy, vertigo and epilepsy. Not surprisingly, he devoted

<sup>23</sup> Boerhaave, *Academical Lectures*, vol. II, 345.

<sup>24</sup> Boerhaave, *Academical Lectures*, vol. II, 313.

<sup>25</sup> Roe S.A., "Anatomia animata: The Newtonian Physiology of Albrecht von Haller", in Mendelsohn E. (ed.), *Transformation and Tradition in the Sciences. Essays in Honor of I. Bernard Cohen* (Cambridge: 1984) 276.

much attention to the *sensorium commune* and the serious ailments caused by its malfunctioning. For our purpose, Boerhaave's neurology lectures are particularly interesting because they clearly reveal the nature of Boerhaave's physiology as a theoretical philosophical discipline.

In Boerhaave's time the concept of *sensorium commune* was extremely vague. It had no basis in anatomy and it was also denied that it was rooted in the soul.<sup>26</sup> It was generally believed to be a junction in the brain where the nerves from the five senses come together and pool their impressions. According to Jessica Riskin, it was axiomatic to physiologists up until the nineteenth century.<sup>27</sup> Furthermore, with the emergence of theories on irritability and sensibility, the working of the *sensorium commune* was widely discussed. Above all, the *sensorium commune* was a speculative philosophical idea and changed along with the 'big' changes in physiology. In the case of Boerhaave, William Harvey's theory of the blood circulation proved crucially important for his understanding of the *sensorium commune*.

Originally the idea of *sensorium commune* was based on Aristotle, who in his *De anima* and *Parva naturalia* devoted much attention to the faculties of sense perception. He localised the *koinon aisthêtêrion*, or the *sensorium commune*, in the heart. He defined it as a central organ where all sense perceptions are integrated and where the objects of sensation are linked to the sensations itself. In other words, through the working of the *sensorium commune* we can see and hear at the same time and the *sensorium commune* links a sound to the sensation of hearing. Under the influence of Hippocrates and Galen the *sensorium commune* was no longer placed in the heart, but localised in the foremost part of the ventricles in the brain. A narrow understanding of the *sensorium commune*, as a place where sensory perceptions were integrated to form a unified perception, changed under the influence of the new natural philosophy. Particularly in the eighteenth century, as a result of experiments on irritability, the *sensorium commune* was more explicitly linked than before to the working of the body. The *sensorium commune* now became seen as the

---

<sup>26</sup> A modern definition of *sensorium commune* is 'the part of the cerebral cortex that receives and coordinates all the impulses sent to individual nerve centers. Includes auditory, gustatory, olfactory, somatosensory and visual centers'. See: <http://medical-dictionary.thefreedictionary.com/sensorium+commune>. Last accessed in December 2009.

<sup>27</sup> Riskin J., *Science in the Age of Sensibility. The Sentimental Empiricists of the French Enlightenment* (Chicago: 2002) 25. Among the physiologists Riskin mentions Herman Boerhaave, Albrecht von Haller, Charles Bonnet, Georges Buffon and ultimately P.J.G. Cabanis, J.B. Lamarck and Georges Cuvier.

most important organ for the transmission of sensory impressions from the sensorial nerves to the motor nerves. It was believed that this process took place irrespective of the animal being conscious or not. Moreover, conscious involuntary motions such as sneezing, coughing and vomiting were considered the result of the working of the *sensorium commune*. Conscious actions were also thought to be mediated by the *sensorium commune*, although it was argued that they were directed and moderated by the mind. As the *sensorium commune* became more important in the explanation of the functioning of the body, it was no longer confined only to the mind's perception and localised in the lateral ventricles of the brain, but was extended to the *medulla oblongata*, *crura cerebri*, *cerebella*, part of the *thalami optici* and the whole spinal marrow.<sup>28</sup>

Boerhaave's physiology of the *sensorium commune*, and particularly his later views, reflect the eighteenth-century move away from the classical explanation of the *sensorium commune* solely in terms of synthesising perceptions, towards a focus on the translation of sense perceptions into bodily action. At the beginning of his career, and in pursuit of Hippocrates and Galen, Boerhaave localised the *sensorium commune* in the brain. However, some decades later, in the lectures on nervous diseases he linked the *sensorium commune* to the concept of *hormê* (the moving force, preserving life and transmitting the impulses of the mind to the body) and he situated both in the endless number of points in the brain and spinal cord where sensorial nerve fibres enter and motor nerves depart.<sup>29</sup> Boerhaave stated:

And therefore there is from the instrument of perception towards almost all solid parts of the body, a system or junction, which is one and the same for the whole body, and consists only of the observing and the moving nervous machine, the *machina nervosa*. If you take everything else away, man would consist of nerves only.<sup>30</sup>

<sup>28</sup> Bennett M.R. – Hacker P.M.S., *History of Cognitive Neuroscience* (Oxford: 2008) 220–222.

<sup>29</sup> In his commentary on Boerhaave's lectures, Schulte characterises Boerhaave's understanding of *hormê* as Hippocratic (See Schulte, *Praelectiones* 387). However, *ὁρμη* does not occur in the Hippocratic Corpus in the required sense. I cannot argue the point here in detail, but it is likely that Boerhaave's concept of *hormê* stemmed from Stoicism, perhaps mediated through Galen.

<sup>30</sup> Boerhaave in Schulte, *Praelectiones, prae.* 77. Boerhaave here uses the word 'instrument' in the same way as it was used in eighteenth-century chemistry, i.e. in order to denote a set of problems regarding the action and mechanisms of certain (chemical) operations rather than the agents by which operations are initiated and accomplished. See Powers J.C., "Chemistry without Principles: Herman Boerhaave on Instruments and

In other words, the *sensorium commune* was central to Boerhaave's image of the body as a machine working according to the laws of nature. He considered it to be the place where sense perceptions entered to be translated into actions, which means that, for instance, when someone decides to walk from Leiden to Amsterdam and back the body will automatically do so. The *sensorium commune* was the closest Boerhaave came to explaining the mutual influence of the body upon the mind and vice versa. Although historians of medicine have discussed Boerhaave's ideas on the mind and the body in terms of Cartesian or occasionalist philosophy, Boerhaave himself always remained extremely elusive about the connection between the mind and the body.<sup>31</sup> He maintained that the physician should restrict himself to the observable bodily effects of the relation between them.

Historians have also used Boerhaave's definition of the *sensorium commune* in order to argue that, for Boerhaave, the *sensorium commune* was the 'central switch centre' of the nervous machine. B.P.M. Schulte, for instance, named Boerhaave (rather than Descartes) as one of the first 'supporters of the theory of reflexes'.<sup>32</sup> However, we should not understand Boerhaave's *sensorium commune* as a forerunner of modern theories of the reflexes, but rather in the context of the theory of circulation which at the time was a central reference in almost all physiology.

After the publication of Harvey's *De Motu Cordis* in 1628 the whole of physiology needed to be reformulated and, as Roger French has argued, physicians in Holland were particularly busy discussing and implementing the new theory.<sup>33</sup> Boerhaave was no exception. He argued:

Concerning physiology, which is called *oeconomia hominis, theoria medica*, or the doctrine of the use of the parts, good authors are lacking, because *everything stated before 1628 was wrong*, Harvey's theory on the circulation of the fluids being unknown, even though this is the only cause of all action;

---

Elements", in Principe L. (ed.), *New Narratives in Eighteenth-Century Chemistry* (Dordrecht: 2007) 45–61.

<sup>31</sup> Schulte and Wright have discussed Boerhaave's ideas in Cartesian terms, while Luyendijk-Elshout has suggested that his views are in line with occasionalism. For a discussion of the historians' viewpoints see also: Thomson A., *Bodies of Thought. Science, Religion and the Soul in the Early Enlightenment* (Oxford: 2008) 178–179.

<sup>32</sup> Schulte, *Praelectiones* 391. See also Schulte B.P.M., "The Concepts of Boerhaave on Psychic Function and Psychopathology", in Lindeboom G.A., *Boerhaave and his Time. Papers read at the International Symposium in Commemoration of the Tercentenary of Boerhaave's Birth* (Leiden: 1970) 100.

<sup>33</sup> French R., "Harvey in Holland: Circulation and the Calvinists", in French R. – Wear A. (ed.), *The Medical Revolution of the Seventeenth Century* (Cambridge: 1989) 47.

consequently, everything that has been written before is not only useless but also pernicious.<sup>34</sup>

'Action' instead of 'function' became the key to Boerhaave's medicine and, in his physiology of action, the circulation of fluids through the body was of crucial importance.<sup>35</sup> In his lectures on nervous diseases, Boerhaave assigned a special place to the *sensorium commune*. He argued that as the heart propels the blood through the body, so the *sensorium commune* gives an impulse to the nervous fluids so that they keep circulating. This is not to say that Boerhaave argued for the primacy of either the heart or the *sensorium commune*, for he maintained that the blood system and the nervous system depended on one another for a healthy functioning of the body. Thus, although the functioning of the heart depended on the *cerebellum* and nerves stimulating the muscles into action, yet at the same time the power of the nervous system depended on the blood from the aorta pulsed towards the brain from the heart.<sup>36</sup>

In Boerhaave's view, nervous diseases were almost always a problem of obstructed circulation of nervous fluids. For instance, Boerhaave ascribed the cause of apoplexy (comparable to a stroke) to an obstruction in the nerves so that the nervous fluids would be unable to return and pass through the *sensorium commune*. So instead of circulating to the limbs and other organs, the fluids from the brain remain in the heart and so cause paralysis.<sup>37</sup>

The most serious diseases were caused by a disturbance in the *sensorium commune* itself. For instance, Boerhaave ascribed the cause of catalepsy – a rare disease in which the patient suddenly is unable to move and is left void of any feeling, remaining in the position he was in at the moment the disease struck – to a malfunctioning of the *sensorium commune*. Ultimately Boerhaave attributed the cause of the disease to a fault in the circulation of the nervous fluids. He argued that the *sensorium com-*

---

<sup>34</sup> Boerhaave in Luyendijk-Elshout A.M., "The Anatomical Illustrations in the London Edition (1741) of Part I of Herman Boerhaave's *Institutiones medicae*", in Lindeboom G.A. (ed.), *Boerhaave and His Time. Papers Read at the International Symposium in Commemoration of the Tercentenary of Boerhaave's Birth* (Leiden: 1970) 86. My italics.

<sup>35</sup> Luyendijk-Elshout, "The Anatomical Illustrations" 86.

<sup>36</sup> Boerhaave in Kegel-Brinkgreve – Luyendijk-Elshout, *Boerhaave's Orations* 255.

<sup>37</sup> Boerhaave Herman, *Boerhaave's Aphorisms. Concerning the Knowledge and Cure of Diseases* (Leiden: 1715) 264–265.

*mune* 'sends forth its supply of Spirits only to these nerves that were in action at the time of the disease's first invasion'.<sup>38</sup>

Boerhaave situated the cause of many mental aberrations in the circulatory power of the *sensorium commune*, maintaining that an obstruction of the circulation of nervous fluids could result in an impairment of the operations of the mind and will.<sup>39</sup> In this way, so Boerhaave believed, a nervous disorder could disclose itself *per consensum* in another place in the body. For instance, he attached great value to the opinion that a mental disorder could show itself in the stomach. He believed that a delirium accompanying a pneumonia could be understood as a disease of the brain caused *per consensum* by a malfunctioning of the lungs. I would argue that Boerhaave could only propose this because he believed in the *circulation* of nervous fluids and the *sensorium commune* as its central cause. Thus, in Boerhaave's physiology, a person is calm and cheerful as long as the circulation of nervous fluid is secure. As soon as the transformation of nervous fluid from the sensory nerve fibres to the motor nerves is disturbed, delusions, mania, insanity, delirium and so on arise.

Boerhaave's treatment of mental disorders is, in almost all cases, directed at the *sensorium commune*. For the treatment to be successful it had to be radical. For instance, in the case of severe dizziness he advised the use of a swivel chair, in which the patient was turned around very swiftly until he was unconscious. In the case of insanity he recommended prolonged immersion in water until a state of apparent death was reached. Ultimately, he aimed at a kind of 'shock therapy' on the *sensorium commune*. He told his students about a nobleman from Brabant who had drowned but was brought back to life (his respiration, sense and faculties of life were restored) because 'a person skill'd in nature' ordered air to be blown up the man's anus using a pair of bellows.<sup>40</sup> It was precisely this kind of shock therapy that the South-American slave administered to the 'dead' girl because, in Boerhaave's reading of the episode, the slave shocked the *sensorium commune* into life in order to 'excite them [the nerves] to motion, make the heart contract, and propel forward its blood'.

---

<sup>38</sup> Boerhaave, *Aphorisms* 274–275.

<sup>39</sup> Wright J.P., "Boerhaave on Minds, Human Beings, and Mental Disorders", *Studies in Eighteenth-Century Culture* 20 (1990) 296.

<sup>40</sup> Boerhaave, *Academical Lectures*, vol. I, 90–91.



### *Hippocrates*

How did Boerhaave merge his 'Harveian' physiology of the nerves with the Hippocratic medicine he taught at Leiden University? It is well known that he was an ardent supporter of Hippocrates.<sup>41</sup> He started and ended his academic career with orations on Hippocrates. He thought it particularly necessary to speak about the 'Father of Medicine', because he had noticed that the Moderns, in pursuit of Bacon, 'went further than Sir Francis himself in their wholesale rejection of classical wisdom and did not make an exception for Hippocrates when they proclaimed the necessity of turning away from ancient authority'.<sup>42</sup> Boerhaave stated that

[...] nowadays indifference and arrogance prevail in medical studies to such an extent that the memorable writings of Hippocrates are scorned, neglected, and considered to be almost worthless.<sup>43</sup>

Boerhaave had noticed many errors in the Hippocratic writings, but warned against throwing out the baby with the bath water. Supporting Hippocrates, he argued that the post-Hippocratic writings from Plato, Aristotle and Galen right down to Paracelsus contained even more serious errors. He believed that after a thorough cleansing of medicine 'only a few points that had already been stated by Hippocrates' would remain. He saw the projects and discoveries of the Moderns, if based on observing and understanding nature, as essentially a continuation of Hippocratic medicine. In other words, he used the history of medicine in order to preach that all medical writers 'owed to Hippocrates everything that was good in their work', urging them to study the works of Hippocrates 'night and day'.<sup>44</sup>

---

<sup>41</sup> Of course Boerhaave's Hippocratic system was Hippocratic after a fashion. As historians have already noted before, the Hippocrates that Boerhaave represented was essentially a Boerhaavian interpretation. See: Smith W.D., *The Hippocratic Tradition* (Ithaca: 1979) 27; Cunningham A., "Medicine to Calm the Mind: Boerhaave's Medical System and why it was adopted in Edinburgh", in Cunningham A. – French R. (eds.), *The Medical Enlightenment of the Eighteenth Century* (Cambridge: 1990) 49. For Boerhaave's Hippocratic medicine see also Knoeff R., "Practising Chemistry 'after the Hippocratical Manner': Hippocrates and the Importance of Chemistry for Boerhaave's Medicine", in Principe L. (ed.), *New Narratives in Eighteenth-Century Chemistry* (Dordrecht: 2007); Powers J.C., *Herman Boerhaave and the Pedagogical Reform of Eighteenth-Century Chemistry* (unpublished PhD. dissertation Indiana University: 2001).

<sup>42</sup> Kegel-Brinkgreve – Luyendijk-Elshout, *Boerhaave's Orations* 56.

<sup>43</sup> Boerhaave Herman, *De commendando studio Hippocratico* (Leiden: 1701). Translated in Kegel-Brinkgreve – Luyendijk-Elshout, *Boerhaave's Orations* 65–66.

<sup>44</sup> Boerhaave Herman, *Commentariolus* XII. See Lindeboom, *Herman Boerhaave* 381.

Recent scholarship on the Hippocratic tradition starts from the assumption that 'Hippocrates is not so much a real person, as a malleable cultural artifact, constantly moulded and remoulded according to need'.<sup>45</sup> Particularly from the sixteenth century onwards Hippocrates was considered an alternative to Galenic medicine and there was a Hippocratic revival at medical centres across Europe.<sup>46</sup> Boerhaave likewise used Hippocrates for his own ends. It has been argued that he mainly adopted Hippocrates as a handy leg-up in the medical faculty, which was oriented towards Hippocratic teaching.<sup>47</sup> However, Boerhaave's exuberant praise of Hippocrates until the end of his medical career indicates more than just political and pragmatic reasons. Boerhaave saw the right method for studying nature as paradigmatically expounded in Hippocrates. What he appreciated most in Hippocrates was the latter's insistence on the appearance of diseases in a plurality of forms asking for a plurality of cures, as well as Hippocrates' emphasis on observation as a method to reach true knowledge. It naturally followed, according to Boerhaave, that students, before advising patients and administering cures, had to *understand* the nature of the body and its diseases. He urged them to follow nature as their only guide (as Hippocrates had done before them) and never to rely on 'idle' speculations and preconceived doctrines. As a result, Boerhaave's medical works did not list remedies for particular diseases, but consisted of Hippocratic statements of wisdom, such as 'desperate cases need the most desperate remedies' (Hippocrates), or 'the most simple diseases can be traced back to the most simple fibres' (Boerhaave). Boerhaave's Hippocratic medicine, in other words, put one's own *observation* and *understanding* centre stage, rather than the following of one's teacher.<sup>48</sup> This was exactly the reason why Boerhaave could easily incorporate the discoveries of the Moderns into his Hippocratic physiology – after all, if obtained via the right 'Hippocratic method', all discoveries could add to and improve the Hippocratic corpus.

With respect to physiology, Boerhaave promoted a 'Hippocratic' methodology, leaving ample space for new discoveries and ideas. Even

---

<sup>45</sup> Cantor D., "The Uses and Meaning of Hippocrates", in Cantor D. (ed.), *Reinventing Hippocrates* (Aldershot: 2002) 3.

<sup>46</sup> See Nutton V., "Hippocrates in the Renaissance", *Sudhoff's Archiv*, suppl. 27 (1989) 420–439; Lonie I.M., "The 'Paris Hippocratics': Teaching and Research in Paris in the Second Half of the Sixteenth Century", in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 155–172.

<sup>47</sup> See Powers, *Herman Boerhaave*.

<sup>48</sup> I have argued this more extensively in Knoeff, "Boerhaave at Leiden".

more, he considered the discoveries of the 'Moderns', provided they were acquired through the right Hippocratic method, an explanation of Hippocratic medicine. As I have argued above, he claimed that 'everything stated before 1628 (the publishing date of Harvey's *De motu cordis*) was wrong'. This, however, did not include Hippocrates. Quite the opposite; he argued that Harvey's doctrine was not contrary to, but an explanation of Hippocrates:

[T]he progress of physic may be commodiously divided into the ancient before Harvey, and the modern after his time; for he so happily managed his discoveries and opinions, that he seems to have gained the consent of almost all the physicians before his death; for Hippocrates, who was a careful observer of nature, being certain of the causes, has alone left us the truest accounts of her appearances; nor is the doctrine of Harvey contrary to that of Hippocrates, but rather an explanation of it.<sup>49</sup>

In his 1715 oration Boerhaave seamlessly fitted ideas on circulation into a Hippocratic framework. He asked his audience:

Who will be able to set forth what nature requires for the hair's nourishment, when he knows nothing about all liquids that are kept going through the body's vessels by a continuous motion? Again the Hippocratic oracles resound as follows: 'the food given to the stomach, and subjected to various activities of nature, is eventually employed for the formation of a hair'.<sup>50</sup>

Here Boerhaave ascribed to Hippocrates the view of his own time that fluids 'are kept going by a continuous motion' and that even the growth of a hair depends on the circulation of fluids (nutrition, after all, happens in the smallest vessels of the nervous system).

Boerhaave's students got the message. For instance, Edward Barry, who graduated under Boerhaave in 1719, was full of praise for his master and argued that 'by the assistance of a full knowledge of the ancient [Hippocratic in particular] and modern discoveries, an unwearied industry, and an uncommon genius, he [Boerhaave] has already done the greatest service to the art of physic, and seems to be most capable of bringing it nearest to perfection'.<sup>51</sup> Ten years after Boerhaave's death John Barker (medical writer and physician to his majesty's forces in the Low Countries)

<sup>49</sup> Boerhaave, *Academical Lectures*, vol. I, 42.

<sup>50</sup> Boerhaave Herman, *Certo in physica* (Leiden: 1715), in Kegel-Brinkgreve – Luyendijk-Elshout, *Boerhaave's Orations* 172.

<sup>51</sup> Barry E., *A Treatise on a Consumption of the Lungs. With a Previous Account of Nutrition, and of the Structure [sic] and Use of the Lungs. By Edward Barry, M.D.* (Dublin: 1726) 15.

still claimed Boerhaave's ability in 'following, and improving upon the Plan, which these Authors [Hippocrates and Sydenham] had laid down, that he himself rose to that high degree of Reputation which he enjoyed while living, and which his Works will remain in Possession of, as long as Physick continues to be an Art'.<sup>52</sup> Robert James inserted translations of lengthy passages of Boerhaave's first oration on Hippocrates in the preface of his *Medical Dictionary* (1743) and Diderot used these passages again in the article on 'medicine' in the *Encyclopédie*.<sup>53</sup> Although the fact that Boerhaave adopted Hippocrates as his medical hero was not new, he was extraordinarily successful in creating an image of Hippocrates that for a long time became the standard view of the 'Father of Medicine'.<sup>54</sup>

In order to show how Boerhaave fitted the physiology of his time into a Hippocratic plan, I conclude with a short discussion of Boerhaave's lectures on epilepsy. From March to June 1735, Boerhaave extensively discussed epilepsy in 32 lectures at the end of his course on nervous diseases. He treated no other nervous disease in such detail. The lectures are full of references to Hippocrates and Aretaeus of Cappadocia, one of Hippocrates' earliest and most ardent followers.<sup>55</sup> Furthermore, the layout of the lecture course shows striking similarities with the Hippocratic treatise *On the Sacred Disease*. He followed Hippocrates by using similar wording in dismissing the opinion that epilepsy had a divine origin, and also with respect to prognosis and therapy. Against those who pretend to cure epilepsy through incantations and other 'divine' treatments, Boerhaave argued that 'it is most advantageous to discuss the Hippocratic treatment of epilepsy'.<sup>56</sup> His veneration for Hippocrates was so great that he even ascribed to Hippocrates some of the discoveries of his own time. For instance, when explaining that epilepsy can be caused by the presence of air in the blood vessels so that the flow of blood is obstructed, Boerhaave states with reference to Hippocrates' *De flatibus*: 'Did Hippocrates perhaps know about the spirits?'<sup>57</sup> The nature and working of 'the spirits' were

<sup>52</sup> Barker J., *An Essay on the Agreement betwixt Ancient and Modern Physicians. Or a Comparison between the Practice of Hippocrates, Galen, Sydenham, and Boerhaave* (London, G. Hawkins: 1748) 73.

<sup>53</sup> Kegel-Brinkgreve – Luyendijk-Elshout, *Boerhaave's Orations* 305, n. 8.

<sup>54</sup> This has also been argued by Cunningham in his "Medicine to Calm the Mind" 49.

<sup>55</sup> For Hippocrates on epilepsy see: Temkin O., *The Falling Sickness. A History of Epilepsy from the Greeks to the Beginnings of Modern Neurology* (Baltimore: 1945); Baumann E.D., *De Heilige Ziekte* (Rotterdam: 1923).

<sup>56</sup> Boerhaave in Schulte, *Praelectiones*, prae. 150.

<sup>57</sup> Boerhaave in Schulte, *Praelectiones*, prae. 151.

areas of speculation in the physiology of Boerhaave's time, but unknown in the Hippocratic works.

Boerhaave defined epilepsy as a serious disease, sometimes inherited, but mostly caused either by an abnormal shape of the skull, the cerebral membranes or the brains or because of a stagnation of foul fluids or a defect of the *sensorium commune*.<sup>58</sup> After presenting many different cases, he argued that the disease has many appearances, but two defining characteristics: the ceasing of all perception and the confusion of muscular motion. The convulsed muscles press upon the arteries and veins so that the fluids stagnate in the body. Hence, many epileptics have a surplus of water in their brain, tears in their eyes and a running nose. In worse cases, the vessels in the brain are so confused that they violently press the blood towards the outer extremities causing puffy eyes, a swollen mouth and bruises. As a result, after an epileptic fit the arteries and veins lack blood, causing weakness of the vegetative, animal and sensitive soul.

In lecture 150 Boerhaave explained to his students the advantages of following Hippocrates in the treatment of epilepsy. He started summarising Hippocrates' view that phlegmatic, rather than bilious, people tend to suffer from epilepsy.<sup>59</sup> Both Hippocrates and Boerhaave believed that the brain is cleansed by phlegm and that a surplus or deficiency of the fluid would hurt the brain. The condition and flow of phlegm depends on temperature (heat causes a discharge and cold an obstruction of phlegm) and temperament (fear or crying can suffocate the spirits). Boerhaave's treatment of the disease is mainly directed at changing the circumstances that cause a fit, so he – like Hippocrates – advised a change of temperature and diet, and the avoidance of mental strain.

Boerhaave also introduced something new in his 'Hippocratic' discussion of the disease. He located the origin of an epileptic seizure not only in the brain (such as a dent in the skull and brain or a surplus or deficiency of phlegm in the brain), but also in the *sensorium commune*. In many instances, he argued, an epileptic fit could be caused through irritation of the nerves of the stomach or the heart.<sup>60</sup> In these instances a poison changes, confuses and destroys the working of the *sensorium commune*, so that the transmission of sense perception into motion is disrupted and the nervous system is in great disorder. In many cases he recommended

<sup>58</sup> Boerhaave in Schulte, *Praelectiones, prae.* 146.

<sup>59</sup> Boerhaave in Schulte, *Praelectiones, prae.* 150–151; Lloyd, *Hippocratic Writings* 242.

<sup>60</sup> Boerhaave in Schulte, *Praelectiones, prae.* 67.

a treatment directed at removing the poisonous spirits in the blood and stomach, consisting of emetics and, sometimes, bloodletting. In extreme cases of epilepsy the therapy was directed towards shocking the *sensorium commune* into action again; he described to his students cases cured by strokes of the cane, marriage and extreme fear.

In Boerhaave's treatment of epilepsy, in short, the new physiology of circulation dovetailed with the Hippocratic medicine taught in the accepted medical curriculum. In all cases and in line with Hippocrates, Boerhaave argued that epilepsy has multiple causes and he urged his students to carefully *observe* and *understand* the nature of each and every individual epileptic disease. Treatment in almost all cases was directed at removing the cause of irritation of the nervous system, *i.e.* at the restoring of the circulatory power of nervous fluids in the brain and nerves.

### Conclusion

Using the example of Boerhaave's neurology, I have argued that it is problematic to speak of a changing physiology at the early modern Leiden medical faculty. Boerhaave, known for his eclecticism, formulated a physiology that combined ancient medicine and early modern anatomical discoveries. Just how Hippocratic was Boerhaave's physiology? He incorporated ideas of Aristotle, the Stoics, Galen and even early moderns like Harvey to such an extent that we can hardly call his physiology 'Hippocratic' anymore. Primarily, Boerhaave appreciated and adopted the 'openness' of the Hippocratic system, which, according to him, was based on the assumption that everything is relevant as long as it is rooted in observation and thorough reasoning. This enabled Boerhaave to freely adopt and combine ideas and discoveries that were not directly discussed in the Hippocratic treatises, but which added to his understanding of Hippocratic physiology. Ultimately, it was the *philosophical* nature of physiology which allowed Boerhaave to fit essentially philosophical hypotheses into a Hippocratic framework.

For Boerhaave's physiology of the nervous system, Harvey's theory of the blood circulation was crucially important. Boerhaave was not alone in considering Harvey's *De Motu Cordis* (1628) the most important work of his time. Most notably, the anatomical preparations made by his close friends Frederik Ruysch and Bernard Siegfried Albinus were based on a thorough understanding of the circulation of fluids through the tubes and vessels of the body. Circulation was the catchword in the medical world

of Boerhaave's time and it is no surprise that his lectures on the nervous diseases, which were essentially a continuation of classical writings on the brain and nerves, also matched the new physiology of circulation.

Does this mean that in the case of Boerhaave's teaching we can speak of a changing concept of physiology? Ultimately the answer must be 'No, we cannot'. Although Harvey's discovery of the circulation was to have profound consequences for early modern physiology, it did not change the nature of physiology as such. It still remained a *philosophical* discipline embedded in natural philosophy – the questions remained the same and even the topics did not drastically change. Boerhaave's physiology of the nerves shows precisely this. His neurology, which he understood as the branch of medicine dealing with the 'commerce between the mind and the body', was essentially philosophical. It dealt with classical speculative philosophical topics such as the *sensorium commune*, the concept of *hormê* and the nature of medical spirits. It asked the same old questions of *why* they worked as they did. Even the fact that Boerhaave took his students to the hospital did not change the fundamentally philosophical character of his teaching. His clinical lectures on nervous diseases were not discussions of individual patients; instead, he used case studies in order to illustrate nervous conditions, ultimately directed towards a rational understanding of the nervous system and its diseases. The only change was that Boerhaave fitted Harveian ideas on circulation into the 'old' physiology taught at the university.



### Selective bibliography

- BARKER JOHN, *An Essay on the Agreement betwixt Ancient and Modern Physicians. Or a Comparison between the Practice of Hippocrates, Galen, Sydenham, and Boerhaave* (London, G. Hawkins: 1748).
- BARRY EDWARD, *A Treatise on a Consumption of the Lungs. With a Previous Account of Nutrition, and of the Structure [sic] and Use of the Lungs. By Edward Barry, M.D.* (Dublin: 1726).
- BAUMANN E.D., *De Heilige Ziekte* (Rotterdam: 1923).
- BENNETT M.R. – HACKER P.M.S. (eds.), *History of Cognitive Neuroscience* (Oxford: 2008).
- BEUKERS H., "Clinical Teaching in Leiden from its Beginning until the End of the Eighteenth Century", *Clinical Teaching Past and Present. Clio Medica* 21 (1987–1988) 139–152.
- BOERHAAVE HERMAN, *Aphorismi de cognoscendis et curandis morbis* (Leiden, Johannes van der Linden: 1709).
- , *Dr. Boerhaave's Academical Lectures on the Theory of Physic. Being a Genuine Translation of his Institutes and Explanatory Comment* (London, W. Innys: 1751).
- , *Institutiones medicae* (Leiden, Johannes van der Linden: 1708).
- CANTOR D., "The Uses and Meaning of Hippocrates", in Cantor D., *Reinventing Hippocrates* (Aldershot: 2002) 1–18.
- COOK H.J., "Boerhaave and the Flight from Reason in Medicine", *Bulletin for the History of Medicine* 74 (2000) 221–240.
- CUNNINGHAM A., "Medicine to Calm the Mind: Boerhaave's Medical System and why it was adopted in Edinburgh", in Cunningham A. – French R. *The Medical Enlightenment of the Eighteenth Century* (Cambridge: 1990) 40–66.
- , *The Anatomist Anatomis'd. An Experimental Discipline in Enlightenment Europe* (Aldershot: 2010).
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.
- DAREMBERG C., *Histoire des Sciences Médicinales* (Paris: 1870), vol. 2.
- FRANK R., *Harvey and the Oxford Physiologists. A Study of Scientific Ideas* (Berkeley: 1980).
- FRENCH R., "Harvey in Holland: Circulation and the Calvinists", in French R. – Wear A. (eds.), *The Medical Revolution of the Seventeenth Century* (Cambridge: 1989).
- KEGEL-BRINKGREVE E. – LUYENDIJK-ELSHOUT A., *Boerhaave's Orations* (Leiden: 1983).
- KNOEFF R., "Boerhaave at Leiden: Communis Europae praeceptor", in Arrizabalaga J. – Cunningham A. – Grell O.P. (eds.), *Centres of Medical Excellence? Medical Travel and Education in Europe, 1500–1789* (Aldershot: 2010) 269–286.
- , "Chemistry, Mechanics and the Making of Anatomical Knowledge: Boerhaave vs. Ruysch on the Nature of the Glands", *Ambix* 53 (2006) 201–219.
- , *Herman Boerhaave (1668–1738). Calvinist Chemist and Physician* (Amsterdam: 2002).
- , "Practising Chemistry 'after the Hippocratical Manner': Hippocrates and the Importance of Chemistry for Boerhaave's Medicine", in Principe L. (ed.), *New Narratives in Eighteenth-Century Chemistry* (Dordrecht: 2007) 63–76.
- LINDEBOOM G.A. (ed.), *Haller in Holland. Het Dagboek van Albrecht von Haller van zijn Verbliff in Holland 1725–1727* (Delft: 1958).
- , *Herman Boerhaave. The Man and his Work* (Leiden: 1968).
- LONIE I.M., "The 'Paris Hippocratics': Teaching and Research in Paris in the Second Half of the Sixteenth Century", in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 155–172.

- LUYENDIJK-ELSHOUT A.M., "Mechanicisme contra Vitalisme: De School van Herman Boerhaave em de Beginselen van Leven", *Tijdschrift voor de Geschiedenis der Geneeskunde, Natuurwetenschappen, Wiskunde en Techniek* 5 (1982) 16–26.
- , "The Anatomical Illustrations in the London Edition (1741) of Part I of Herman Boerhaave's *Institutiones medicae*", in Lindeboom G.A. (ed.), *Boerhaave and his Time. Papers Read at the International Symposium in Commemoration of the Tercentenary of Boerhaave's Birth* (Leiden: 1970) 83–92.
- NUTTON V., "Hippocrates in the Renaissance", *Sudhoff's Archiv*, suppl. 27 (1989) 420–439.
- POWERS, J.C. "Chemistry without Principles: Herman Boerhaave on Instruments and Elements", in Principe L. (ed.), *New Narratives in Eighteenth-Century Chemistry* (Dordrecht: 2007) 45–61.
- , *Herman Boerhaave and the Pedagogical Reform of Eighteenth-Century Chemistry* (unpublished PhD thesis Indiana University: 2001).
- RISKIN J., *Science in the Age of Sensibility. The Sentimental Empiricists of the French Enlightenment* (Chicago: 2002).
- RISSE G.B., "Clinical Instruction in Hospitals: The Boerhaavian Tradition in Leyden, Edinburgh, Vienna and Pavia", *Clinical Teaching Past and Present. Clio Medica* 21 (1987–1988) 1–19.
- ROE S.A., "Anatomia animata: The Newtonian Physiology of Albrecht von Haller", in Mendelsohn E. (ed.), *Transformation and Tradition in the Sciences. Essays in Honor of I. Bernard Cohen* (Cambridge: 1984) 273–300.
- SCHULTE B.P.M., *Herman Boerhaave praelectiones de morbis nervorum 1730–1735* (Leiden: 1959).
- , "The Concepts of Boerhaave on Psychic Function and Psychopathology", in Lindeboom G.A., *Boerhaave and his Time. Papers Read at the International Symposium in Commemoration of the Tercentenary of Boerhaave's Birth* (Leiden: 1970) 93–101.
- SMITH W.D., *The Hippocratic Tradition* (Ithaca: 1979).
- TEMKIN O., *The Falling Sickness. A History of Epilepsy from the Greeks to the Beginnings of Modern Neurology* (Baltimore: 1945).
- THOMSON A., *Bodies of Thought. Science, Religion and the Soul in the Early Enlightenment* (Oxford: 2008).
- ULTEE M., "The Politics of Professional Appointment at Leiden, 1709", *Journal for the History of Medicine and Allied Sciences* 9 (1990) 167–194.
- WRIGHT J.P., "Boerhaave on Minds, Human Beings, and Mental Disorders", *Studies in Eighteenth-Century Culture* 20 (1990) 289–302.

# THE ANATOMY AND PHYSIOLOGY OF MIND. DAVID HUME'S VITALISTIC ACCOUNT

Tamás Demeter

## *Summary\**

This paper challenges the widely held view which associates Hume's philosophy with mechanical philosophies of nature and particularly with Newton. This view presents Hume's account of the human mind as passive receiver of impressions that bring into motion, from the outside, a mental machinery whose functioning is described in terms of mechanical causal principles. Instead, I propose an interpretation which suggests that, for Hume, the human mind is composed of non-modular faculties that can be characterised by their active contribution, which frequently results in qualitative change. This anatomy of the mind is explored from a physiological perspective focused on the study of the normal functioning and interaction ascribed to the mind's various organs. While pursuing this enterprise, Hume's outlook is closer to Scottish 'philosophical chemistry' and vitalistic physiology than to the mechanical heritage of the seventeenth century.

## *Introduction*

Hume's project, as developed in his *Treatise of Human Nature* (1739/1740), is frequently labelled as a Newtonian exercise *sans phrase*.<sup>1</sup> And while it is worthwhile to read Hume's project of exploring human nature in the context of eighteenth-century Newtonianism, using merely this label falls short of saying something substantive about Hume's work. The reason is two-fold. On the one hand, there are several distinctive Newtonian traditions in the eighteenth century,<sup>2</sup> so to use the label without further clarification

---

\* I am indebted for helpful comments and discussion to David Bloor, John Christie, Brad Hume, Hans-Jörg Rheinberger, Henning Schmidgen, Ursula Klein, Jeffrey Schwegman, Kelly Wilder and Gábor Zemlén. My research has been supported by the Hungarian Scientific Research Fund (OTKA 79193), and forms part of the research project SROP-4.2.1.B-10/2KONV-2010-0002.

<sup>1</sup> See e.g. Stroud B., *Hume* (London: 1977) 8. Some more recent examples: Mounce H.O., *Hume's Naturalism* (London: 1999) 15–18, Dicker G., *Hume's Metaphysics and Epistemology* (London: 1998) 2–5, Pitson A.E., *Hume's Philosophy of the Self* (London: 2002) 6, 14, 152., Beebe H., *Hume on Causation* (London: 2006) 5, 183–185.

<sup>2</sup> Schofield R.E., "Evolutionary Taxonomy of Eighteenth-Century Newtonianisms", *Studies in Eighteenth-Century Culture* 7 (1978) 175–192. See also Shapiro A.E., *Fits, Passions, and*

is too vague. On the other hand, there are several passages in Hume that seem to be critical of some central concepts in, and several others that do not fit the outlook of, Newton's *Principia* with which Hume's theory is frequently associated.<sup>3</sup> Without clarifying these points it is hard to see in what sense Hume's work can be labelled as Newtonian, and how it can be linked to the traditions of eighteenth-century natural inquiry. This is a missing but crucial piece of a puzzle in Hume scholarship: in order to understand how he saw himself as contributing to the joint explanatory enterprise of moral and natural philosophy, we must locate him properly in the context of eighteenth-century natural philosophy.

In this essay I intend to clarify the character of Hume's project in Newton's wake, and primarily in the context of eighteenth-century Scottish natural philosophy. I am going to argue that the theory Hume elaborates is a qualitatively oriented *and* a predominantly vitalistic account of human nature. As such it is congruent *in its outlook and language* with the philosophical chemistry and vitalistic physiology that were the prominent orientations of natural inquiry in the Scottish Enlightenment, and as such it can be placed in the broader European context of Enlightenment vitalism.<sup>4</sup> Replacing the *Principia's* ideal of couching explanations in terms of external immaterial forces acting on homogeneous inert matter, this new vitalism rehabilitated an appeal to qualitative differences and active material principles while explaining observable phenomena.<sup>5</sup> During the course of the eighteenth century, this outlook became dominant in those fields of natural inquiry where the mechanical approach failed to deliver satisfactory explanations – especially in exploring the qualitative differences and interactions between chemical substances, the nature of qualitative change, and in tracking the phenomena of active, living matter. And this is also characteristic to Hume's theory of human nature.

Hume's project has affinities with William Cullen's chemical doctrines, which defined the research agenda of eighteenth-century Scottish

---

*Paroxysms. Physics, Method, and Chemistry and Newton's Theories of Colored Bodies and Fits of Easy Reflection* (Cambridge: 1993).

<sup>3</sup> See Schliesser E., "Hume's Newtonianism and Anti-Newtonianism", in Zalta E.N. (ed.), *The Stanford Encyclopedia of Philosophy* (2007) <http://plato.stanford.edu/archives/win2008/entries/hume-newton>, and also Buckle S. *Hume's Enlightenment Tract* (Oxford: 2002), Wright J.P., *Hume's A Treatise of Human Nature* (Cambridge: 2009).

<sup>4</sup> Reill P.H., *Vitalizing Nature in the Enlightenment* (Berkeley: 2005).

<sup>5</sup> Reill P.H., "The Legacy of the 'Scientific Revolution'", in Porter R. (ed.), *Cambridge History of Science. Volume 4. Eighteenth-Century Science* (Cambridge: 2003) 38.

chemistry.<sup>6</sup> Chemistry for Cullen is a *qualitative* enterprise founded on the method of analysis of substances into 'constituent parts'. As opposed to mechanical investigations into 'general properties' common to all bodies, i.e. shape, size, etc., Cullen's chemistry is aimed at exploring the 'particular properties' of bodies, inducing such properties in bodies that do not have them, and producing bodies with such properties.<sup>7</sup> The project's focus on particular properties requires looking at substances through an ontology sensitive to qualitative differences. Therefore chemical inquiry cannot proceed by a mechanical analysis of bodies into 'integrant parts' by the division of matter into smaller parts with an attention to its 'general properties'. Instead, chemistry studies those properties of bodies that depend on their mixture by means of analysis of compounds into 'constituent parts'. This means a qualitative analysis of the different constituents of which a given mixture is composed, and it aims at studying those components with respect to their 'habits of mixture' and to the 'properties of mixts from different ingredients'.<sup>8</sup>

Chemical investigations in eighteenth-century Scotland were largely driven by their potential use in medical practice. Although the first professors of the Edinburgh medical school were educated at Leiden, and they imported to Scotland a Boerhaavean mechanistic approach, Edinburgh quickly turned into a centre of *vitalistic physiology* and, from the second third of the century, offered an alternative to Boerhaavean medical orthodoxy. Edinburgh professors like William Porterfield and Robert Whytt emphasised the *active* influence the mind exerts on physiological processes.<sup>9</sup> Porterfield developed a vitalistic account of binocular motions that enable us to judge the distance of objects, and then extended it to other bodily motions too. In his view it is custom and habit, arising from a rational and voluntary decision, that stabilise the processes as a result of

---

<sup>6</sup> See my "Post-Mechanical Explanation in the Natural and Moral Sciences: The Language of Nature and Human Nature in David Hume and William Cullen", *Jahrbuch für Europäische Wissenskulturr* (forthcoming).

<sup>7</sup> See Donovan A.L., "William Cullen and the Research Tradition of Eighteenth-Century Scottish Chemistry", in Campbell R.H. – Skinner A.S. (eds.), *The Origins and Nature of the Scottish Enlightenment* (Edinburgh: 1982) 101.

<sup>8</sup> Donovan A.L., *Philosophical Chemistry in the Scottish Enlightenment* (Edinburgh: 1975) 97–99.

<sup>9</sup> See Wright J.P., "Metaphysics and Physiology: Mind, Body, and the Animal Economy in Eighteenth-Century Scotland", in Stewart M.A. (ed.), *Studies in the Philosophy of the Scottish Enlightenment* (Oxford: 1990) and his "Materialism and the Life Soul in Eighteenth-Century Scottish Physiology", in Wood P. (ed.), *The Scottish Enlightenment. Essays in Reinterpretation* (Rochester: 2000).

which we cannot but constantly focus our eyes. This habit thus becomes a law that the mind imposes on itself because of the intrinsic utility it has in judging distance.

As his student notes testify, Whytt attended the classes of George Young, an adjunct teacher at Edinburgh medical school, who taught him to be sceptical about mechanical explanations in physiological matters because, as he saw it, presupposing a hidden mechanism behind muscular motion is empirically ungrounded. Whytt, similarly, explained bodily responses as arising from 'an active sentient principle' of which we may lack sufficient theoretical knowledge, but we can know its workings from the direct experience of how it feels. Although its workings are frequently unconscious, it is due to us being habituated to them and to them being gentle themselves. Gradually distancing himself from Porterfield's theory, with the sentient principle Whytt offered a unified account of bodily processes replacing rationality with feeling as its basic principle. Whytt's was a picture of various parts of the body communicating via the nervous system and responding to stimuli involuntarily and unconsciously. Although they disagreed in several respects, Porterfield and Whytt agreed on at least one point which may be called their common vitalistic stance: namely that living organisms are active in the sense that they respond with more energy than contained in the stimuli, so they cannot be studied along the same lines as dead matter. In the explanation of living matter the perspective of mechanical aggregation must give way to that of animal economy.

In Scotland a vitalistic vocabulary extended its influence beyond the disciplinary boundaries of medical investigations into the realm of the moral sciences. There are traces of an important influence of a vitalistic outlook and language in Adam Smith's economic theory. It is centred on the idea of a natural balance in the economic body governing itself with its own internal active forces. Smith depicts this body as a living organism whose activities are conceived as interconnected parts of a larger whole whose balance is maintained by 'some unknown principle of preservation' explicitly compared to the unknown, vital 'principle of animal life'.<sup>10</sup> Adam Ferguson also emphasises the explanatory deficiencies of analogies drawn between the inanimate material world and society on the basis that the latter is composed of 'living and active members'. For him, adopting the perspective of mechanical theories of inert matter in moral phi-

---

<sup>10</sup> Packham C., "The Physiology of Political Economy: Vitalism and Adam Smith's Wealth of Nations", *Journal of the History of Ideas* 63 (2002) 465–481, 468.

losophy can only mean that the dynamic nature of social phenomena is overlooked.<sup>11</sup>

As I suggest in this paper, Hume's theory of human nature is also informed by similar vitalistic tendencies and thus it can be placed in this context. As a student at Edinburgh University, Hume took classes in natural philosophy and later he quite probably read medical works by Bernard Mandeville and George Cheyne that introduced him to contemporary physiological ideas.<sup>12</sup> While writing up the *Treatise* (1735–1737) he was working in Reims, using Noël-Antoine Pluche's library, and in La Flèche, the leading Jesuit centre of experimental physics at that time. Later he was active in the Philosophical Society of Edinburgh, for a while as its secretary, even editing some of its publications in natural philosophy; and he had friends like William Cullen and Joseph Black.<sup>13</sup> Throughout his life he was surrounded by ideas of natural philosophy, and his work was not left untouched by them.

In this paper I intend to show that it is much closer to the actual spirit of Hume's work to read it against the background of the metaphor of a qualitatively and vitalistically oriented *anatomy* of the human mind, which is built upon the foundations of its *physiology*. It is important to emphasise that talking about Hume's anatomy and physiology of mind is metaphorical: it signals the transmission of a language of natural phenomena to the moral domain. Hume sees moral philosophy, that is, the study of moral beings *qua* moral beings, as an independent enterprise: while he certainly thought that natural philosophy could serve as a model and inspiration for moral philosophy, and that it could provide the proper methods as well, still moral philosophy represents an autonomous perspective for him, from which phenomena characteristic to human beings *qua* moral beings could be studied. This is why Hume takes pains to demarcate his inquiries from anatomy and physiology as disciplines of natural philosophy while repeatedly proclaiming himself explicitly an anatomist of human nature.<sup>14</sup>

<sup>11</sup> See Reill, *Vitalizing Nature* 69–70.

<sup>12</sup> See Wright, *Hume's A Treatise*, 8–9, 16–17.

<sup>13</sup> See Barfoot M., "Hume and the Culture of Science in the Early Eighteenth Century" in Stewart M.A. (ed.), *Essays in the Philosophy of the Scottish Enlightenment* (Oxford: 1990) and Schabas M., *The Natural Origins of Economics* (Chicago: 2005) 65–70.

<sup>14</sup> See Hume David, *Treatise on Human Nature*: ed. Norton D.F. – Norton M.J. (Oxford: 2007) 1,1,2 and 3,3,6,6 (References to this work are normally in the form: Book.Part.Section. Paragraph.)



*Hume's qualitative project. The anatomy of mind*

Let me begin with a quotation which I think aptly represents the consensus of most commentators, as well as the public image of Hume: 'On Hume's analysis, the mind is a compound entity, but it is not composed of independent faculties, as in the scholastic account. The components of the mind are perceptions, unified by relations of resemblance, causation, and the operation of sympathy'.<sup>15</sup> If this view of the Humean mind as nothing but a *bundle of perceptions* is right, then it would make little sense to talk about anatomy here. But there is something intrinsically suspicious about this and similar quotations: what is sympathy if not a faculty that can operate on some perceptions? And what is the ability to recognise resemblances if it is not a faculty? Hume is very much aware that resemblance does not supervene exclusively on the intrinsic properties of perceptions, because if this was the case then some philosophical reflection would reveal that everything resembles everything, whereby resemblance would lose all its explanatory power as a principle of association.<sup>16</sup> Yet, as a matter of fact, resemblance as a natural relation holds only between *some* perceptions. Therefore it seems quite natural to suppose that there is some faculty that is responsible for picking out some resemblances as salient from among the infinitely many possible ones, thus making them available as the basis of a principle of association. And there is one, indeed: it is memory that is effective in 'producing the relation of resemblance among the perceptions' – we remember past impressions as being similar.<sup>17</sup>

Hume sees his own identity as that of an 'anatomist of the human mind'. This metaphor is central throughout the *Treatise* and later in the *Enquiry concerning Human Understanding*. It emerges in a 1739 letter to Hutcheson in a famous comparison with the painter of human nature:

There are different ways of examining the Mind as well as the Body. One may consider it either as an Anatomist or as a Painter; either to discover its most secret Springs and Principles or to describe the Grace and Beauty of its Actions. I imagine it impossible to conjoin these two Views. Where you pull off the Skin, and display all the minute Parts, there appears something trivial, even in the noblest Attitudes and most vigorous Actions: Nor can you ever

---

<sup>15</sup> McIntyre J.L., "Hume's 'New and Extraordinary' Account of the Passions", in Traiger S. (ed.), *The Blackwell Guide to Hume's Treatise* (Oxford: 2006) 211.

<sup>16</sup> Hume, *Treatise* 1,1,5,3.

<sup>17</sup> Hume, *Treatise* 1,4,6,18.

render the Object graceful or engaging but by clothing the Parts again with Skin and Flesh, and presenting only their bare Outside. An Anatomist, however, can give very good Advice to a Painter or Statuary: And in like manner, I am persuaded, that a Metaphysician may be very helpful to a Moralist; tho' I cannot easily conceive these two Characters united in the same Work.<sup>18</sup>

This is consonant with the view Hume expounds in the Introduction to the *Treatise*, namely, that the science of human nature is the foundation of all further knowledge; it is, as it were, the first philosophy on which, to some degree, all the branches of knowledge depend, 'since they lie under the cognizance of men, and are judged of by their powers and faculties'.<sup>19</sup> Our knowledge is *human* knowledge through and through: we cannot know its limits and extent without exploring first the kind of knowledge we are capable of having at all.

But Hume's anatomy of the mind offers more than that: the 'delineation of the distinct parts and powers of the mind'<sup>20</sup> yields a descriptive-explanatory account of both human knowledge *and* action – which is contrasted with the moralists' normative enterprise. Hume summarises the methodological *credo* of the *Treatise's* project thus:

'tis at least worth while to try if the science of *man* will not admit of the same accuracy which several parts of natural philosophy are found susceptible of. There seems to be all the reason in the world to imagine that it may be carried to the greatest degree of exactness. If, in examining several phænomena, we find that they resolve themselves into one common principle, and can trace this principle into another, we shall at last arrive at those few simple principles, on which all the rest depend. And tho' we can never arrive at the ultimate principles, 'tis a satisfaction to go as far as our faculties will allow us.<sup>21</sup>

As he explains, the 'logic' he follows in pursuing this project is a causal one; it aims at revealing human nature with an attention to the causal contribution these principles make.<sup>22</sup> The task of the anatomist of human mind begins where that of the anatomist, physiologist and natural philosopher ends, and it is continuous with theirs. And vice versa: it is their task to submit explanations where the study of human nature cannot go further as in the case of primary impressions which, if looked at from the perspective

<sup>18</sup> Hume David, *Letters of David Hume*: ed. Greig J.Y.T. (Oxford: 1932) 1: 32–33.

<sup>19</sup> Hume, *Treatise* Introduction.4.

<sup>20</sup> Hume David, *Enquiry concerning Human Understanding*: ed. Beauchamp T. (Oxford: 2000) 1,13.

<sup>21</sup> Hume, *Treatise* Abstract.1.

<sup>22</sup> Hume, *Treatise* 1,3,15,11.

of moral philosophy, arise 'in the soul originally, from unknown causes' and whose proper study is anatomy and natural philosophy.<sup>23</sup>

The task of the moral philosopher starts from the most basic level directly experienced by, and relevant to the understanding of moral beings, namely on the level of perceptions. On Hume's account, there are two kinds of perceptions in the mind which are the building blocks of all human cognition: impressions and ideas, and both can be simple and complex. Impressions are the matter of actual experience, and they are either provided by the senses or by reflection which produces passions. Ideas are representations of these impressions, most aptly seen as mental images or concepts. As he frequently emphasises, the difference between these two kinds of sensation consists in the *force and vivacity* with which they present themselves: simple ideas are fainter copies of simple impressions. Force and vivacity come in degrees. Most commentators take this difference in degree as being the only difference that distinguishes impressions from ideas; thus it is also implied that there are no qualitative differences between them. But this view can be challenged by a rarely quoted passage from the *Treatise*:

Ideas may be compar'd to the extension and solidity of matter, and impressions, especially reflective ones, to colours, tastes smells and other sensible qualities. Ideas never admit of a total union, but are endow'd with a kind of impenetrability, by which they exclude each other, and are capable of forming a compound by their conjunction, not by their mixture. On the other hand, impressions and passions are susceptible of an entire union and like colours, may be blended so perfectly together, that each of them may lose itself, and contribute only to vary that uniform impression, which arises from the whole. Some of the most curious phænomena of the human mind are deriv'd from this property of the passions.<sup>24</sup>

One could perhaps say that here Hume just echoes the then commonplace Cartesian dictum that passions are clear, i.e. vivid perceptions, but they are not distinct. But one should not overlook the language in which the distinction is drawn: the passage clearly suggests that there are, indeed, *qualitative* differences between impressions and ideas; their interactions follow different principles. On the one hand, ideas are characterised by mechanical properties that are preserved in their interactions: they are and always remain atomistic. This also means that the formation of a complex idea is a reversible process: its building blocks can be

<sup>23</sup> Hume, *Treatise* 1,1,2.

<sup>24</sup> Hume, *Treatise* 2,2,6,1.

combined and recombined in various ways without losing their identity. Impressions, and especially passions, on the other hand, are susceptible of qualitative transformations, and they are characterised by properties and interactions that are not explained in a mechanical way.

Hume's famous 'missing shade of blue' thought experiment shows that this difference has real philosophical import, and it is not just an illusion arising from a fanciful metaphorical language.<sup>25</sup> Here Hume discusses a puzzling exception to his general rule that simple ideas are copies of previous simple impressions. He claims that if we are presented with a colour scale gradually descending from light blue to dark blue with one particular shade of blue missing in it somewhere, then we *can* imagine the idea of that missing shade without having been encountered it before in the form of an impression. While admitting this case as an exception to the general authority of his copy claim, Hume dismisses it as a peripheral one not worthy of serious consideration.

It is important to note that this problem would not even emerge if ideas and impressions were not qualitatively different. If ideas were not characterised by mechanical properties, but they were presented in a manner like impressions, then it would be quite natural to say that it is of course possible to produce the idea of the missing shade: by mixing the ideas of the two neighbouring shades one could easily imagine the missing shade. But one cannot do this, as ideas, being atomistic, cannot interact this way.

And this introduces an important lesson for the anatomy project. If ideas are copies of impressions, then there must be a principle of human nature causally responsible for copying. Furthermore, if ideas and impressions are qualitatively different, then this principle must exert an active, *transformative* influence on the impressions provided by the senses, and reflection must do the same when producing passions from ideas. And if it is possible, even if only in exceptional cases, to produce an idea without a preceding impression, then again, there must be some principle accounting for that too. The principles themselves are also *qualitatively distinguished* by the kind of activity they exert on various perceptions, and also by the kind of perception they exert it on – as the extract quoted concerning impressions and ideas suggests. Specific principles apply to different kinds of impression, deriving either from the senses or reflection, and also to ideas depending on their content. The task is to explore

---

<sup>25</sup> Hume, *Treatise* 1,1,1,10.

qualitatively different principles identified through their distinctive causal contribution to the constitution of human nature.

There is evidence that Hume understood Newton's *Opticks* as 'anatomical' in a similarly qualitative way. While his own purpose is to 'anatomise human nature in a regular manner', he has Cleanthes say in his *Dialogues concerning Natural Religion* that Newton 'gives a minute anatomy of the rays of light', and that '[l]ight is in reality anatomised'.<sup>26</sup> This is an enterprise Newton himself characterises as an analysis of 'compounds to ingredients' in order to explore the 'original differences of rays of light'.<sup>27</sup> This inquiry, especially if seen in the light of the anatomy metaphor, also seems qualitative in character, and this understanding seems to be analogous with how Hume sees his own task: to analyse compound human nature into its functionally different ingredients, defined in terms of the characteristic principles that apply to them, i.e. in terms of their original differences. This is the sense in which Hume's method can be aptly characterised as Newtonian: much more in the spirit of the *Opticks*, and especially of its *Queries*, than that of the *Principia*. And this orientation is consistent with that of the qualitatively oriented philosophical chemistry in the Scottish Enlightenment as developed by Cullen and others.<sup>28</sup>

### *The anatomy of mind. Hume's faculty psychology*

While there are indeed passages where Hume says things like 'they are successive perceptions only, that constitute the mind',<sup>29</sup> it would still miss the point of Hume's entire project to stop just there. While it is true that for Hume the *contents* of the mind consist entirely of perceptions, yet his aim, as he frequently emphasises, is to find the *principles* that describe the causal framework of how those perceptions follow one another. It is therefore misleading to say that there is nothing more to the Humean mind than its contents: one can reveal systematic interconnections among its contents, to establish them as principles whose interconnections can

<sup>26</sup> Hume, *Treatise* Abstract.2 and Hume David, *Dialogues concerning Natural Religion*: ed. Kemp Smith N. (Edinburgh: 1974) 136.

<sup>27</sup> Newton Isaac, *Philosophical Writings*: ed. Janiak A. (Cambridge: 2004) 139.

<sup>28</sup> See my "Post-Mechanical Explanation" and also Wilson D.B., *Seeking Nature's Logic. Natural Philosophy in the Scottish Enlightenment* (University Park, PA: 2009) 80–82 and 141–142.

<sup>29</sup> Hume, *Treatise* 1.4.6.4.

be revealed as well. And these findings can be used for the purposes of explanation of why perceptions follow one another in the order they do. Without some commitment to the existence and stability of such principles Hume's project would lose its point.

The epistemic status of these principles of human nature is similar to those of natural philosophy: we are presented with human phenomena and the philosopher's task is to explain them by reference to the principles productive of them. These principles are not perceived directly, and we have no impressions of them. Instead, they are revealed by empirical reasoning and thus our knowledge of them is fallible: only the contents of the mind are given, while the principles applied in their explanation are theoretical constructs.<sup>30</sup> Therefore they do not presume a robust ontological commitment on Hume's part, only a tentative or instrumental one, to the extent that they can be used for the purposes of useful and satisfactory explanations.<sup>31</sup>

These principles are not scattered regularities, but they are indeed *structured*, and in this sense the universal anatomy of the human mind is analogous with the structure of the body: 'The case is the same with the fabric of the mind, as with that of the body. However the parts may differ in shape or size, their structure and composition are in general the same. There is a very remarkable resemblance, which preserves itself amidst all their variety'.<sup>32</sup> As some of these principles interact more closely they can be conveniently subsumed under various *faculties*, so he talks freely, for example, about the universal principles of imagination, of sympathy,<sup>33</sup> as well as of other faculties, their limits and imperfections. Talk about faculties is abundant throughout the text; sometimes they are referred to straightforwardly as the 'organs of the human mind' as in the case of the faculty which is responsible for producing passions, i.e. reflection.<sup>34</sup>

The Humean recipe for charting the anatomy of human mind seems to be this:<sup>35</sup> compare phenomena, find analogies between them, ascribe them to principles, resolve them into more general ones if possible, and find their place in the structure of their interaction in producing the phenomena. This is a predominantly *reductive stance* that seeks to subsume a

<sup>30</sup> Hume, *Treatise* 1,2,5,19.

<sup>31</sup> Hume, *Enquiry* 1,9 and 7,29.

<sup>32</sup> Hume, *Treatise* 2,1,11,5.

<sup>33</sup> Hume, *Treatise* 1,1,4,1 and 2,2,5,14.

<sup>34</sup> Hume, *Treatise* 2,1,5,6.

<sup>35</sup> On Hume's method see my "Hume's Experimental Method", *British Journal for the History of Philosophy* 20, 2012 (forthcoming).

variety of phenomena under a handful of principles, and it makes Hume's theory immune to charges of emptiness like the one Locke advanced earlier:

we may as properly say, that 'tis the singing *Faculty* sings, and the dancing *Faculty* dances; as that the *Will* chuses, or that the Understanding conceives; or, as is usual that the *Will* directs the Understanding, or the Understanding obeys, or obeys not the *Will*: It being altogether as proper and intelligible to say, that the power of Speaking directs the power of Singing, or the power of Singing obeys or disobeys the power of Speaking.<sup>36</sup>

Surely, this passage can be used only as a malicious caricature of Hume's project. Subsuming various phenomena under qualitatively different causal principles can hardly be seen as offering empirically empty tautologies.

This method results in a set of principles belonging to various faculties as the constituent parts of a compound human nature. The list of faculties includes sensation, memory, imagination, reason, judgement, reflection, and sympathy. Will is conspicuously missing from the list. But on second thought it is not surprising: given that for Hume will is not a faculty but 'the internal impression we feel and are conscious of, when we knowingly give rise to any new motion of our body, or new perception of our mind',<sup>37</sup> and as such it is explicitly compared to passions like pride and humility, that are subject to the principles of reflection. Conscious will is just a 'false sensation',<sup>38</sup> not a faculty that could play a directive role in action. And there is a general lesson here: contrary to the dominant view of scholastic and several early modern authors where reason is normatively prescribed the role of a supreme faculty that should direct action,<sup>39</sup> there is *no comparable hierarchy of faculties* in Hume. Although he famously claims that '[r]eason is, and ought only to be the slave of the passions',<sup>40</sup> so that it might sound as if reflection, as the faculty responsible for the production of passions, should stand at the top, yet passions themselves are part of a causal structure of perceptions governed by the principles of various faculties, e.g. 'custom and repetition' which have a great effect 'both to encrease and diminish our passions'.<sup>41</sup> So, instead of an 'upside-down

---

<sup>36</sup> Locke John, *An Essay concerning Human Understanding*: ed. Nidditch P. (Oxford: 1975) 2,21,17.

<sup>37</sup> Hume, *Treatise* 2,3,1,2.

<sup>38</sup> Hume, *Treatise* 2,3,2,2.

<sup>39</sup> See e.g. McIntyre, "Hume's 'New and Extraordinary' Account".

<sup>40</sup> Hume, *Treatise* 2,3,3,4.

<sup>41</sup> Hume, *Treatise* 2,3,5,1.



rationalist' hierarchical organisation, Humean human nature is characterised by a continuous interplay of various faculties without a dominating centre or director.

Not independently of the lack of hierarchy, Humean faculties are *not distinct modules*, but they interfuse, penetrate one another and they have principles in common. Due to its passivity, the best plausible candidate for a modular faculty is external perception which merely collects impressions. According to Hume's official definition perception is 'a mere passive admission of the impressions thro' the organs of sensation'.<sup>42</sup> Even though it is passive, '[t]hose who are acquainted with the metaphysical part of optics [...] know how we transfer the judgements and conclusions of the understanding to the senses'.<sup>43</sup> Hume here seems to imply a meaning of metaphysics, not uncommon in the period, which bears on the study of the mind and its operations, and in Scotland at that time it was frequently conceived as standing in close relation to physiology. So, beside Berkeley and Malebranche,<sup>44</sup> Hume's insight converges to contemporary physiological discourse too – especially to Porterfield's theory of binocular motions, first published in two parts in 1735 and 1737,<sup>45</sup> according to which it is due to custom and habit that we can focus our eyes and thereby infer the distance of the objects presented in the visual image.<sup>46</sup> However, it is important to note that there are divergences between the concepts of 'custom and habit' in Porterfield and Hume. For Porterfield the emergence of habit is voluntary on the mind's part, and it consists in the mind binding itself by an intrinsically useful law, which is therefore not innate, but 'morally necessary'.<sup>47</sup> For Hume custom and habit, far from being voluntary, are the most fundamental principles of human nature, which can be revealed in the background of several mental processes. Its operation does not depend on, and certainly not supervised by the mind, as Porterfield claims, rather it is a principle constitutive of the mind itself. Porterfield's notions of custom and habit are all too voluntaristic and rationalistic by Hume's standards.

---

<sup>42</sup> Hume, *Treatise* 1,3,2,2.

<sup>43</sup> Hume, *Treatise* 2,2,8,6.

<sup>44</sup> See Editors' annotations Hume, *Treatise*, vol. 2, 747, 853.

<sup>45</sup> Porterfield W., "Essay concerning the Motions of Our Eyes", Part I: "Of Their External Motions" in *Medical Essays and Observations* (Edinburgh: 1735), vol. 3, 160–261; Part II: "Of Their Internal Motions" (Edinburgh: 1737), vol. IV, 124–294.

<sup>46</sup> See Hume, *Treatise* 1,3,9,11 and also Wright, "Metaphysics and Physiology" 265–268.

<sup>47</sup> See e.g. Wright, "Metaphysics and Physiology" 267.

Not only perception but the faculties in general lack clear boundaries in Hume. Association by resemblance is a common principle of both understanding and reflection, and imagination has a great influence on the passions.<sup>48</sup> Due to their common principles the activity of various faculties combines in a dynamic and interactive way in producing various perceptions and actions. These two features, i.e. the *lack of hierarchy and modularity* of faculties, are the distinctive marks of Hume's theory of the human mind, and not, as is commonly held, that he as an associationist 'reduced the powers of the mind to one, the ability to receive impressions' and explained all phenomena of the mind by appeal to laws of association.<sup>49</sup> Hume's mind does not work that way.

Despite not being modular, faculties can be characterised functionally – more precisely, they can be characterised *exclusively functionally*, only by the characteristic activity they exert on specific kinds of perception, as well as by their various influences on each other. The focus on functions is the only appropriate one for 'a just and *philosophical* way of thinking' as contrasted with everyday thinking. In our philosophical – that is, by contemporary standards, explanatory<sup>50</sup> – enterprises 'the distinction which we sometimes make betwixt a *power* and its *exercise* of it, is entirely frivolous, and [...] neither man nor any other being ought ever to be thought possess of any ability, unless it be exerted and put in action'.<sup>51</sup> Accordingly, the faculties of the mind can be studied and described only in terms of their functioning, i.e. by the processes to which they contribute.

While reconstructing Hume's views on morality, Rachel Cohon draws a detailed picture of how the various faculties of reason, sympathy and moral sense work and interact in his account. She characterises them as *processes* in the mind, and suggests that Hume's talk about faculties should be understood this way.<sup>52</sup> This is perfectly legitimate, as faculties within the Humean framework cannot be identified independently of the role they play. However, we should not replace talk about faculties with that of processes just because they are only functionally identifiable. Hume's project aspires to more than a natural history of the mind: it is

<sup>48</sup> Hume, *Treatise* 2,1,4,3 and 2,3,6,1.

<sup>49</sup> Hatfield G., "Remaking the Science of Mind: Psychology as a Natural Science", in Fox C. – Porter R. – Wokler R. (eds.), *Inventing Human Science. Eighteenth Century Domains* (Berkeley: 1995) 188.

<sup>50</sup> See Yeo R., "Classifying the Sciences", in Porter R. (ed.), *Cambridge History of Science. Eighteenth-Century Science* (Cambridge: 2003), vol. 4.

<sup>51</sup> Hume, *Treatise* 2,1,10,4 and see also 1,3,14,34.

<sup>52</sup> Cohon R., *Hume's Morality. Feeling and Fabrication* (Oxford: 2008) 67–69.

a search for the (causal) principles of human nature, which he needs for the purposes of explanation of why perceptions follow one another in the order they do and how actions spring from them. It is thus not merely a project of describing and classifying processes; rather it is to explore the causal potentials the human mind exhibits via exploring and classifying its characteristic activities. Thus allowing for functionally identified faculties exerting active influence on perceptions seems perfectly in order, and fits the textual evidence better.

As Andrew Cunningham recently argued, Hume's view of cognitive activities has a *vitalistic* flavour: it is the mind's internal need for activity that motivates truth-seeking – truth in itself is not enough of a motivation.<sup>53</sup> I suggest that something similar is true about various faculties in particular: the principles Hume establishes describe the characteristic interactions of faculties, the functional structure of human nature whose elements are causally responsible for processing perceptions relevant to them. This process is not typically mechanical, and cannot be understood in terms of impressions causing ideas and vice versa. As we have seen above, ideas are not just fainter impressions but they are different in kind; the two kinds of perception have different properties and enter into different interactions.

Thus the faculty responsible for copying impressions into ideas must make an *active and qualitative* contribution. So does sympathy: when we form an idea of a passion that someone else is experiencing, it is the operation of sympathy that 'converts' this idea into an impression thereby making it possible to feel what the other feels.<sup>54</sup> Were it not for the active and selective influence of sympathy on *some* ideas, but for a mechanical-causal relation between ideas and impressions, it would then be impossible to explain why only ideas about others' passions are turned into the corresponding impressions. And the case is again similar with imagination, too. We cannot have an impression of a cause; we can have only a repetition of similar cases. But we cannot experience anything in a thousand cases which is not there in a single one. Yet, prompted by several cases, memory, the recognition of resemblances, and habit give rise to 'a determination of the mind', and the way it feels is just the new impression whose copy is the idea of necessary connection, i.e. causation.<sup>55</sup> A similar scenario can provide the solution for the mystery of 'the missing shade

---

<sup>53</sup> Cunningham A.S., "Hume's Vitalism and Its Implications", *British Journal for the History of Philosophy* 15 (2007) 59–73.

<sup>54</sup> See Hume, *Treatise* 2,1,11,3 and 3,3,1,7.

<sup>55</sup> Hume, *Treatise* 1,3,14,15–20.

of blue': having experienced the regular succession of shades, a similar determination of the mind can give rise to the impression necessary for the idea of the missing shade.

*The physiology of mind. The study of its normal functioning*

Given that we cannot directly observe our faculties or their principles, we can only chart our 'mental anatomy' via inferences from their effects. Introspection is of no use here: reflecting on mental processes distorts them, so self-observation or contrived inner experience cannot be appropriate ways of studying them, as they 'wou'd so disturb the operation of my natural principles, as must render it impossible to form any just conclusion from the phænomenon'.<sup>56</sup> Hume's anatomical project proceeds via the study of processes taking place in the mind, and its proper method is to find analogies among a variety of human phenomena and trace them back to their causal sources. This task converges with the contemporary understanding of medical anatomy and physiology. Cullen, for example, shares this view of the anatomist's task when he says 'from anatomy you know minutely the structure of the human body itself', a knowledge to be augmented with physiology from which 'you know the general laws by which the animal economy is governed, and these detailed in explaining the function of each particular part'.<sup>57</sup> But due to Hume's functionalist outlook, 'parts and powers' cannot be separated: we have no direct introspective access to the mind's parts; therefore we can have no knowledge of its anatomy as independent of the functioning of its different parts. Given Hume's anatomy metaphor, it is only through a physiology of the mind, i.e. through the study of the general laws of its normal functioning, that we can have access to its anatomy.

Apart from occasional excursions into the territory of actual physiological explanations, Hume keeps his science of man as an autonomous domain of explanations. Nonetheless, these scattered passages are enough to testify that he did not consider the body as a mechanical or hydraulic machine in a Boerhaavean manner. Instead he shares the view of Cullen and other Scottish physiologists like Porterfield and Whytt, namely, that

<sup>56</sup> Hume, *Enquiry* 1,13 and *Treatise*, Introduction.10.

<sup>57</sup> Cullen W., "Lectures Introductory to the Course on the Practice of Physic", in *The Works of William Cullen* (Edinburgh: 1827), vol. 1, 440.

mind and body mutually influence one another.<sup>58</sup> In these passages, for example, Hume turns to a physiological explanation of mistakes in reasoning couched in terms of animal spirits, or argues from the analogies between human and animal anatomy and physiology that the mental capacities of animals must be similar to those of humans, different mostly in degree and not in kind.<sup>59</sup>

Beyond this implicit and vague adherence to some sort of physiological theory, it is also true, at a more general level, that the Humean *language* of human nature is predominantly a language of active vital forces *and* qualitative, chemical changes, and not of the widespread image of an 'Enlightened Automata'.<sup>60</sup> It is his language and outlook that associates him with Enlightenment vitalism and also with philosophical chemistry and vitalist physiology in Scotland at that time. Hume's perspective can also be characterised by those commitments which, as Peter Hans Reill argues,<sup>61</sup> became widely accepted among natural philosophers during the course of the eighteenth century. Accordingly, human nature is a compound whose constituents are not separable by mechanical means but by qualitative analysis. Human phenomena are thus derived from the interactions of different active components that can be decomposed only to a certain point, whose qualitative differences are never entirely resolved, and whose combination is regulated, also depending on qualitative differences. This is the language Hume speaks while discussing the physiology of the human mind, and not the mechanical language of external forces acting on homogenous ingredients.

If ideas and impressions are considered qualitatively uniform, then it is particularly tempting to say that the way Hume envisages the interaction of ideas and impressions is modelled on Newton's theory of gravity.<sup>62</sup> It seems the principles of *association* are especially susceptible of such an interpretation. And indeed, we have seen that ideas are partly characterised by a mechanical description, especially by their solidity and their capability

---

<sup>58</sup> Wright J.P., "Substance versus Function Dualism in Eighteenth-Century Medicine", in Wright J.P. – Porter P. (eds.), *Psyche and Soma. Physicians and Metaphysicians on the Mind-Body Problem from Antiquity to Enlightenment* (Oxford: 2002) 251 and Reill, *Vitalizing Nature* 122–125.

<sup>59</sup> Hume, *Treatise* 1,2,5,20 and *Enquiry* 9,1.

<sup>60</sup> See Schaffer S., "Enlightened Automata", in Clark W. – Golinski J. – Schaffer S. (eds.), *The Sciences in Enlightened Europe* (Chicago: 1999) 126–165.

<sup>61</sup> Reill, *Vitalizing Nature* 78.

<sup>62</sup> See e.g. Broughton J. "Impressions and Ideas" in Traiger S. (ed.), *The Blackwell Guide to Hume's Treatise* (Oxford: 2006) 51. See also Pitson, *Hume's Philosophy* 14; Beebe, *Hume on Causation* 15.

of forming a union only by conjunction, which preserves their atomistic identity, and not by mixture. On the surface, it makes sense to say that out of the three principles of association between ideas, i.e. cause-effect, spatio-temporal contiguity, and resemblance, at least two, namely cause-effect and contiguity, seem to be mechanistically respectable. But resemblance should incite our suspicion, as it cannot be conceived as a mechanical, only as an intentional, relation which implies the active contribution of the mind. On second thought, cause-effect and contiguity do not fare much better against a mechanical background. Ideas are qualitatively different; they do not differ in shape, size and solidity but in *content*, i.e. in what they represent. Representational contents, and not mechanical features, are the properties on which possible associations depend, and it is also this content that determines the contribution they can make in complex ideas.

Connecting Humean association to Newtonian gravity is typically based on the following passage:

These are therefore the principles of union or cohesion among our simple ideas, and in the imagination supply the place of that inseparable connexion, by which they are united in our memory. Here is a kind of *ATTRACTION*, which in the mental world will be found to have as extraordinary effects as in the natural, and to show itself in as many and as various forms. Its effects are every where conspicuous; but as to its causes, they are mostly unknown, and must be resolv'd into *original* qualities of human nature, which I pretend not to explain.<sup>63</sup>

But nothing suggests here that it is Newton and universal gravity that Hume has in mind. I suggest that, unlike universal gravity or external forces, the principles of association should be understood as chemical processes directed by *elective attractions* between ideas that depend on their representational content. The principles of association are elective: they do not hold universally between all ideas, only between some, and there are, of course, pairs of ideas that do not stand in associative relations at all. The principle of cause-effect can connect two ideas that may not be connected by resemblance, and the possible associative links between any two ideas depend on their *content*. If seen through a mechanical lens, different chains of association cannot be adequately distinguished: the solidity, number and structure of ideas involved in them do not give a fine enough resolution for that purpose. In order to see them adequately, one needs not only to take into account the qualitative differences, i.e. content,

---

<sup>63</sup> Hume, *Treatise* 1,1,4,6.

of ideas but also the particular principle, 'some associating quality',<sup>64</sup> by which they are linked. This results in representationally heterogeneous chains of association held together by elective attractions between ideas.

Although chemical attractions were sometimes conceived by analogy with Newtonian forces, this was not the only way of thinking about them. Cullen, for example, argued that Newtonian gravity could not be an adequate model for chemistry because the latter is focused on the particular features of relative attractions.<sup>65</sup> Elective attractions are the cement of the chemical universe, but not in the sense of Newtonian gravity: while gravity is a universal attraction, Cullen's elective attractions are selective depending on the particular properties of substances and their relative affinities, but not on their density.<sup>66</sup> The business of chemistry is to explore and arrange these attractions systematically, and to account for various combinations and separations of substances in terms of general principles established by such classifications. This notion of elective attraction suits Hume's theory of association much better than universal gravity.

Traces of a qualitatively focused mental physiology are especially conspicuous in Hume's theory of passions. In some passages Hume seems to echo George Cheyne's metaphorical language of musical instruments,<sup>67</sup> and *prima facie* this may suggest Hume's adherence to a mechanical outlook. As Cheyne writes, the brain where 'the Nerves, or Instruments of Sensation terminate' is 'like a *Musician* in a finely fram'd and well-tune'd Organ-Case', and 'these Nerves are like *Keys*, which, being struck or touched convey the Sound'.<sup>68</sup> For Hume the mind with respect to the passions is

not of the nature of a wind instrument of music, which in running over all the notes immediately loses the sound after the breath ceases; but rather resembles a string-instrument, where after each stroke the vibrations still retain some sound, which gradually and insensibly decays. The imagination is extreme quick and agile; but the passions are slow and restive: For

<sup>64</sup> Hume, *Treatise* 1,1,4,1.

<sup>65</sup> See e.g. Klein U. – Lefèvre W., *Materials in Eighteenth Century Science. A Historical Ontology* (Cambridge, Mass.: 2007) 38, 47, 56–57. On the relation of Cullen's concept to that of Buffon and others see Donovan, *Philosophical Chemistry* 130.

<sup>66</sup> See Schofield, *Mechanism and Materialism* 218, and Klein – Lefèvre, *Materials* 38, 47, 56–57. On Cullen's view see Donovan, *Philosophical Chemistry* 130.

<sup>67</sup> Arguably, it was Cheyne to whom Hume intended his famous 'Letter to a physician'. See Burton J.H., *Life and Correspondence of David Hume* (Edinburgh: 1846) 1, 42–43 and more recently Wright J.P., "Dr. George Cheyne, Chevalier Ramsey, and Hume's Letter to a Physician", *Hume Studies* 29 (2003) 125–141.

<sup>68</sup> Cheyne G., *The English Malady* (London: 1733) 4–5.



which reason, when any object is presented, that affords a variety of views to the one, and emotions to the other; 'tho the fancy may change its views with great celerity; each stroke will not produce a clear and distinct note of passion, but the one passion will always be mixt and confounded with the other. According as the probability inclines to good or evil, the passion of joy or sorrow predominates in the composition.<sup>69</sup>

Although on its surface this passage suggests a mechanical imagery of strings, vibrations and winds, the actual emphasis is on qualitatively different passions mixing together, just like sounds, in an unclear and indistinct manner so as to result in a composition.

Hume's passions are secondary impressions produced by the faculty of reflection, and are founded on the pleasant or unpleasant character that conjoins some ideas or primary impressions. The natural path of a single passion, conceived theoretically as a separate entity, is characterised as a qualitative, directional change over time.<sup>70</sup> Its direction is determined by association by resemblance, the only way passions can be associated, and the process can be strengthened by the association of ideas that play a role in the production of passions either as their causes or their objects.<sup>71</sup> The actual dynamics of passions is, of course, more complex, as there are several passions at any time interacting in the mind, induced by legions of impressions and ideas constantly present to it. This interaction is described with instructive similes:

Upon the whole, contrary passions succeed each other alternately, when they arise from different objects: They mutually destroy each other, when they proceed from different parts of the same: And they subsist both of them, and mingle together, when they are deriv'd from the contrary and in compatible chances or possibilities, on which any one object depends. The influence of the relations of ideas is plainly seen in this whole affair. If the objects of the contrary passions be totally different, the passions are like two opposite liquors in different bottles, which have no influence on each other. If the objects be intimately connected, the passions are like an *alkali* and an *acid*, which, being mingled, destroy each other. If the relation be more imperfect, and consists in the contradictory views of the same object, the passions are like oil and vinegar, which, however mingled, never perfectly unite and incorporate.<sup>72</sup>

---

<sup>69</sup> Hume, *Treatise* 2,3,9.

<sup>70</sup> Hume, *Treatise* 2,2,9.

<sup>71</sup> Hume, *Treatise* 2,1,4.

<sup>72</sup> Hume, *Treatise* 2,3,9,17.

More than figurative speech, this is perfectly consistent with the passage in which Hume made a qualitative distinction between ideas and impressions. And it is now hardly surprising to see that there are qualitative differences between passions as well, and that their interactions, which can again be seen in terms of elective attractions, are founded on those differences. Unlike Newtonian forces, the principles of interaction in Hume's mental world are sensitive to differences in kind that resist mathematisation, and belong more organically to the view championed by Cullen in Scotland and Buffon at the same time on the Continent with its emphasis 'on the principles of comparison, resemblance, affinity, analogical reasoning' and its explanations in terms of 'inner, active forces as central agents in nature'.<sup>73</sup>

Probably there is no better example of an active force in Hume's *Treatise* than the operation of *sympathy*, which 'is nothing but the conversion of an idea into an impression by the force of imagination'.<sup>74</sup> The process is simple: from external signs, gestures, speech, etc. we form an idea, via inferences, about what goes on in the other's mind, and sympathy turns this idea into its corresponding impression so that we can literally feel what the other feels.<sup>75</sup> Sympathy is thus an internal active principle of the mind which transforms ideas into impressions thereby facilitating communication of opinions and affections. As it makes us sensitive to the feelings of others, this faculty can aptly be called the basis of sociability. Sympathy is responsible for the bonds in the social world, and as such it is analogous with the cohesive force in the world of living organisms:

this is still more remarkable, when we add a *sympathy* of parts to their *common end*, and suppose that they bear to each other, the reciprocal relation of cause and effect in all their actions and operations. This is the case with all animals and vegetables; where not only the several parts have a reference to some general purpose, but also a mutual dependance on, and connexion with each other.<sup>76</sup>

Sympathy establishes similar reciprocal relations in human interaction, as it is due to it that 'the minds of men are mirrors to one another'.<sup>77</sup> It is thus through the concept of sympathy that the ideas of an organic nature and human nature, the language of chemical reactions and human interactions

---

<sup>73</sup> Reill, *Vitalizing Nature* 69.

<sup>74</sup> Hume, *Treatise* 2,3,6,8.

<sup>75</sup> Hume, *Treatise* 2,1,11,3.

<sup>76</sup> Hume, *Treatise* 1,4,6,12.

<sup>77</sup> Hume, *Treatise* 2,2,5,21.

are contiguous: living things and society are both organised by their peculiar principles into an organic whole.<sup>78</sup> And it is the same image that applies to the functioning of the various organs of the human mind.

### *Conclusion*

In this paper I have argued that, while developing his theory of human nature, Hume adopted a perspective and spoke a language that is convergent to the vitalistic tendencies in the Enlightenment. For Hume the mind is like an organised living body whose anatomy (the structure of its organs, i.e. faculties) is accessible only through its physiology (the study of its normal functioning). The mind is a decentralised system of functional centres characterised by the specific activity they exert on sensations. These functional parts are linked together by various forms of interconnection, interaction and mutual reciprocity. Through the reciprocal relations between various processes Hume charts the anatomy of the mind in which the non-modular interaction of various faculties adds up to a harmonious whole. Appreciating this vitalistic character of Hume's project, and the language he is using while developing it, helps us to a better understanding of what was really important to Hume: the principles of human nature.

---

<sup>78</sup> See Reill, *Vitalizing Nature* 135–142.

*Selective bibliography*

- BARFOOT M., "Hume and the Culture of Science in the Early Eighteenth Century", in Stewart M.A. (ed.), *Essays in the Philosophy of the Scottish Enlightenment* (Oxford: 1990) 151–190.
- BEEBEE H., *Hume on Causation* (London: 2006).
- BROUGHTON J., "Impressions and Ideas" in Traiger S. (ed.), *The Blackwell Guide to Hume's Treatise* (Oxford: 2006) 43–58.
- BUCKLE S., *Hume's Enlightenment Tract* (Oxford: 2002).
- BURTON J.H., *Life and Correspondence of David Hume*, 2 vols. (Edinburgh: 1846).
- CHEYNE G., *The English Malady* (London: 1733).
- COHON R., *Hume's Morality. Feeling and Fabrication* (Oxford: 2008).
- CULLEN W., "Lectures Introductory to the Course on the Practice of Physic", in *The Works of William Cullen* (Edinburgh: 1827), vol. 1, 363–464.
- CUNNINGHAM A.S., "Hume's Vitalism and Its Implications", *British Journal for the History of Philosophy* 15 (2007) 59–73.
- DEMETER T., "Hume's Experimental Method", *British Journal for the History of Philosophy* 20 (2012) forthcoming.
- , "Post-Mechanical Explanation in the Natural and Moral Sciences: The Language of Nature and Human Nature in David Hume and William Cullen", *Jahrbuch für Europäische Wissenschaftskultur* 6 (2010) forthcoming.
- DICKER G., *Hume's Metaphysics and Epistemology* (London: 1998).
- DONOVAN A.L., *Philosophical Chemistry in the Scottish Enlightenment* (Edinburgh: 1975).
- , "William Cullen and the Research Tradition of Eighteenth-Century Scottish Chemistry", in Campbell R.H. – Skinner A.S. (eds.), *The Origins and Nature of the Scottish Enlightenment* (Edinburgh: 1982) 98–114.
- HATFIELD G., "Remaking the Science of Mind: Psychology as a Natural Science", in Fox C. – Porter R. – Wokler R. (eds.), *Inventing Human Science. Eighteenth Century Domains* (Berkeley: 1995) 184–231.
- HUME DAVID, *Dialogues concerning Natural Religion*: ed. Kemp Smith N. (Edinburgh: 1974).
- , *Enquiry concerning Human Understanding*: ed. Beauchamp T. (Oxford: 2000).
- , *Enquiry concerning the Principles of Morals*: ed. Beauchamp T. (Oxford: 1998).
- , *Letters of David Hume*: ed. Greig J.Y.T., 2 vols. (Oxford: 1932).
- , *Treatise on Human Nature*: eds. Norton D.F. – Norton M.J., 2 vols. (Oxford: 2007).
- KLEIN U. – LEFÈVRE W., *Materials in Eighteenth Century Science. A Historical Ontology* (Cambridge, Mass.: 2007).
- LOCKE JOHN, *An Essay concerning Human Understanding*: ed. Nidditch P. (Oxford: 1975).
- MCINTYRE J.L., "Hume's 'New and Extraordinary' Account of the Passions", in Traiger S. (ed.), *The Blackwell Guide to Hume's Treatise* (Oxford: 2006) 199–215.
- MOUNCE H.O., *Hume's Naturalism* (London: 1999).
- NEWTON ISAAC, *Philosophical Writings*: ed. Janiak A. (Cambridge: 2004).
- PACKHAM C., "The Physiology of Political Economy: Vitalism and Adam Smith's Wealth of Nations", *Journal of the History of Ideas* 63 (2002) 465–481.
- PITSON A.E., *Hume's Philosophy of the Self* (London: 2002).
- PORTERFIELD W., "Essay concerning the Motions of Our Eyes", Part I: "Of Their External Motions" in *Medical Essays and Observations*, vol. III (Edinburgh: 1735) 160–261; Part II: "Of Their Internal Motions", vol. IV (Edinburgh: 1737) 124–294.
- REILL P.H., "The Legacy of the 'Scientific Revolution'", in Porter R. (ed.), *Cambridge History of Science. Volume 4. Eighteenth-Century Science* (Cambridge: 2003) 23–43.
- , *Vitalizing Nature in the Enlightenment* (Berkeley: 2005).
- SCHABAS M., *The Natural Origins of Economics* (Chicago: 2005).
- SCHAFER S., "Enlightened Automata", in Clark W. – Golinski J. – Schaffer S. (eds.), *The Sciences in Enlightened Europe* (Chicago: 1999) 126–165.

- SCHLIESSER E., "Hume's Newtonianism and Anti-Newtonianism", in Zalta E.N. (ed.), *The Stanford Encyclopedia of Philosophy* (2007) <http://plato.stanford.edu/archives/win2008/entries/hume-newton/>.
- SCHOFIELD R.E., *Mechanism and Materialism. British Natural Philosophy in an Age of Reason* (Princeton: 1969).
- SHAPIRO A.E., *Fits, Passions, and Paroxysms. Physics, Method, and Chemistry and Newton's Theories of Colored Bodies and Fits of Easy Reflection* (Cambridge: 1993).
- STROUD B., *Hume* (London: 1977).
- WILSON D.B., *Seeking Nature's Logic. Natural Philosophy in the Scottish Enlightenment* (University Park, PA: 2009).
- WRIGHT J.P., "Dr. George Cheyne, Chevalier Ramsey, and Hume's Letter to a Physician", *Hume Studies* 29 (2003) 125–141.
- , "Materialism and the Life Soul in Eighteenth-Century Scottish Physiology", in Wood P. (ed.), *The Scottish Enlightenment. Essays in Reinterpretation* (Rochester: 2000) 177–197.
- , "Metaphysics and Physiology: Mind, Body, and the Animal Economy in Eighteenth-Century Scotland", in Stewart M.A. (ed.), *Studies in the Philosophy of the Scottish Enlightenment* (Oxford: 1990) 251–301.
- , "Substance versus Function Dualism in Eighteenth-Century Medicine", in Wright J.P. – Porter P. (eds.), *Psyche and Soma. Physicians and Metaphysicians on the Mind-Body Problem from Antiquity to Enlightenment* (Oxford: 2002) 237–254.
- YEO R., "Classifying the Sciences", in Porter R. (ed.), *Cambridge History of Science. Eighteenth-Century Science* (Cambridge: 2003), vol. 4, 241–266.

# MORE THAN A FADING FLAME. THE PHYSIOLOGY OF OLD AGE BETWEEN SPECULATIVE ANALOGY AND EXPERIMENTAL METHOD

Daniel Schäfer

## *Summary*

Ancient and early modern notions of ageing posit several reasons for its cause. Along with common intrinsic factors – steady loss of inner warmth and moisture resulting in a lack of blood and semen, as well as insufficient digestion, which in turn leads to an accumulation of putrefying waste products – extrinsic causes are also taken into account: excessive or insufficient cooling through the surrounding air, and incorrect diet. Initially, most of these concepts drew their analogies from nature: withering leaves, the cooling corpse and, above all, the metaphor of the fading lamp or flame, which has been the focus of numerous studies. These conceptions are treated with a certain rigidity in early modern Galenism and proved astonishingly stable. After 1650, however, iatrochemical and iatromechanical ideas presented alternatives, although they, too, initially employed analogies based on the ageing of natural elements, chemical reactions, and machines. In a few places, however – for instance in Francis Bacon's collection of empirical case studies (*Historiae naturales*) – we can glimpse an early tentative attempt to find new heuristic approaches to the physiology of age and ageing. While this specialty was in no way a focus of pre-modern physiology, it proves an ideal test case for studying the use of analogy over the *longue durée* of physiological thought.

## *Overview of the sources*

The physiology of old age and ageing – that is, first and foremost the question of why ageing happens and how it manifests itself – is not a central topic of Greco-Roman natural philosophy and medicine. Indeed, it is even more marginal than related discussions of the dietetics or pathology of ageing.<sup>1</sup> In line with the overall development of physiology,<sup>2</sup> well into the Hellenistic period we mostly encounter statements on the general

---

<sup>1</sup> An overview of ancient pathology, dietetics and treatment of old age can be found in: Schäfer D., *Old Age and Disease in Early Modern Medicine* (London: 2011).

<sup>2</sup> Cf. Rothschuh K.E., *Physiologie. Der Wandel ihrer Konzepte, Probleme und Methoden vom 16. bis 19. Jahrhundert* (Freiburg-Munich: 1968) 13–14; cf. also the contribution of V. Nutton in this volume.

Table 1: Medical Gerocomies and Related Texts 1489–1807

First Print	Author	Short Title
1489	Gabriele Zerbi	<i>Gerontocomia</i>
1489	Marsilio Ficino	<i>De vita lib. 2</i>
1540	Antonio Fumanelli	<i>De senum regimine</i>
1545	Gilbert Fuchs	<i>Gerocomice</i>
1546	Andrés De Laguna	<i>De victus [...] in senectute observanda</i>
about 1570	Girolamo Cardano	<i>De sanitate tuenda lib. IV; Theonoston lib. II</i>
1585	Girolamo Brisiani	<i>Geraeologia</i>
1588	David de Pomis	<i>De senum affectibus</i>
1597	André du Laurens	<i>A discourse [...] of old age</i>
1606	Aurelio Anselmi	<i>Gerocomica</i>
1617	François Fougerolles	<i>De senum affectibus</i>
1621/31	Bernhardin Stainer	<i>Gerocomicon</i>
1627	François Ranchin	<i>Gerokomike</i>
1724	Robert Welsted	<i>De aetate vergente</i>
1724	John Floyer	<i>Gerocomica</i>
about 1750?	John Hill	<i>The old man's guide</i>
1777	Marin Jacques Claire Robert	<i>De la vieillesse</i>
1807	Anonymous	<i>Gérocomie</i>

processes of ageing found in nature, particularly in the works of Plato and (Ps.-)Aristotle (*Parva naturalia*, *Generation of Animals*, *Problems*, *Physics*); Galen and his followers, on the other hand, already referred primarily to man.<sup>3</sup> But it is only in the Islamic and European Middle Ages, especially in Avicenna, (Ps.-)Roger Bacon, and Arnald of Villanova, that accounts of ageing first appear in dedicated chapters and in sub-sections of larger works. Expert literature on caring for the elderly (gerocomies, see Table 1), which comes into being in the late fifteenth century and especially around 1600, emphasises dietetics but routinely includes sections on physiology as well. In contrast, general works on medicine (the *Summae* of Fernel, Riolan, etc.) provide comparatively little information on this topic. Only in the mid-seventeenth century do university writings – particularly doctoral theses, which are now written in large numbers – begin to include works dedicated predominantly or exclusively to the physiology of old age. Until about 1650, the Aristotelian-Galenic paradigm dominates here

<sup>3</sup> Compare Byl S., “La gérontologie de Galien”, *History and Philosophy of the Life Sciences* 10 (1988) 73–92.



as in many other fields of medicine, at least in universities; as it declines, we find in the subsequent 150 years numerous hybrids, varying regionally, with iatrochemical, iatromechanical, or iatrodynamic emphases.

### *Analogies to nature*

The concept of analogy was already in use in Greek Antiquity (originating from the discipline of mathematics). In particular, Aristotle understands it as a logical aid to elucidating phenomena in different domains based on the similarities of their circumstances: if only one of them is completely known, an element of the other is determined by way of analogy ('paradeigma; syllogismos kat' analogian'). In its application, analogy routinely transcends the boundaries between categories by establishing concrete connections across them. Thus structural commonalities are identified without creating new, superordinate kinds (or categories), and without establishing a complete identity between the circumstances being compared.<sup>4</sup> Furthermore, the concept of analogy can also be used to establish a middle term, in the sense of a commensurate relationship between two people and/or things that in themselves are incommensurable: A is to B as C is to D<sup>5</sup> (e.g., elephants are larger and live longer than mice, thus animals with greater mass will age more slowly than those with less mass).<sup>6</sup>

In this way, considerations on the physiology of ageing<sup>7</sup> were speculatively connected to observations from nature, especially in Greek natural philosophy (and in the ensuing two millennia of its reception). This is particularly the case for changes which were connected to drying out, cooling, extinction, putrefaction, or the accumulation of waste products. These keywords already reveal that, from Antiquity until well into the Early Modern period, ageing was usually considered a process closely associated with dying and death. Galen's metaphor of old age as a path towards death<sup>8</sup> is only one of many examples indicating that it was

<sup>4</sup> Kluxen W., "Analogie I.", in Ritter Joachim (ed.), *Historisches Wörterbuch der Philosophie* (Darmstadt: 1971), vol. 1, 214–227, col. 216–217.

<sup>5</sup> Hoenen M.J.F.M., "Analogie", in: Ueding Gert (ed.), *Historisches Wörterbuch der Rhetorik* (Darmstadt: 1992), vol. 1, 498–514, col. 498, 503–504.

<sup>6</sup> Compare Aristoteles, *De longaevitate* 466a12–17.

<sup>7</sup> An overview is provided by Grmek M.D., *On Ageing and Old Age. Basic Problems and Historic Aspects of Gerontology and Geriatrics* (The Hague: 1958).

<sup>8</sup> Galenus, *De temperamentis* 2.2 (2.582 K.).

commonly conceived not as a stage at the end of life but rather as the end of life itself (in the sense of a culmination of life processes, Aristotelian *akmê*); the early modern pun *senectus defectus*<sup>9</sup> once again gave dramatic expression to this view. Only at the end of the nineteenth century did the notion begin to spread that old age is a period of life in its own right, with its own characteristics, and not merely the decline of earlier capacities.

In specialised medical literature, analogies are only seldom drawn explicitly by means of clear biological metaphors ('wilting') or references to nature ('as with plants'). Instead, it is the simple use of significant *nomina* (dry, cold, putrefaction, etc.) that usually indicates that a comparison is being implied. As explained above, however, this does not mean that the reality of human ageing is fully equated with the object to which it is compared.

Analogical thinking becomes most obvious with the phenomenon of wilting as a consequence of *drying out*; in the Mediterranean environment this can be observed especially in plants, due to their relatively large surface area. Drying out thus primarily refers to the effect of an excess of outside heat (e.g., solar radiation) as well as to a lack of available or required moisture. Aristotle and Galen occasionally employ explicit analogies to plants in their remarks on the physiology of old age;<sup>10</sup> a reference to the wrinkled, often dry skin of the elderly could have contributed particularly to this interpretation, even if it is not explicitly mentioned. Aristotle does say, however, that large animals, due to their sheer bulk, do not dry out as easily as small ones and thus generally helps them live longer. Humans doing hard physical labour, on the other hand, age faster, as their work causes them to dry out.<sup>11</sup> Finally, and of obvious importance for the history of early modern geriatrics, Galen compares the drying out resulting from fever (*marasmos*) to natural ageing; both are characterised by emaciation, although in the latter there is no trace of fever.

The notion of *coldness* and *cooling* as supposedly essential features of old age also points to observations from nature. It is probable, although not attested, that old people were equated with cooling corpses. At any rate, Erasmus of Rotterdam, Martin Luther, and other early modern

---

<sup>9</sup> Anselmi Aurelio, *Gerocomica sive de senum regimine. Opus non modo philosophis et medicis gratum, sed omnibus hominibus utile* (Venice, Franciscus Ciottus: 1606) 13, 24.

<sup>10</sup> Aristoteles, *De respiratione* 478b27–28; Galenus, *De sanitate tuenda* 1.2 (6.6 K.) 6.3 (6.399–400 K.).

<sup>11</sup> Arist. *Long.* 466a27–28, b13–14.

authors refer to the elderly as living corpses.<sup>12</sup> And Aristotle – again in *Parva naturalia* – suggests that animals of the same kind live longer in hot countries than in cold ones,<sup>13</sup> and he maintains that the elderly shiver because they are cold from within.<sup>14</sup> The famous Aristotelian comparison of old age to a *fading flame* or (oil) lamp,<sup>15</sup> dominant for two millennia, manages to unite images of drying out and cooling: the flame will dim as its (moist) fuel runs out, and at the same time the warmth it provides disappears.

Aristotle also attributes the *putrefaction* (*sêpsis*) of humid matter to external heat and the absence of air or wind. It is typically the cause for hair becoming grey,<sup>16</sup> which is often compared to developing mould;<sup>17</sup> but even old age as a whole (just like death!) can be considered a process of putrefaction.<sup>18</sup>

In another analogy, Galen mentions ‘earthy’ dry particles (*ousiai*) in the bodies of adults and the elderly that do not ‘burn’ properly (in contrast to the oily ‘fuel’ of young people), resulting in the development of smoky vapours.<sup>19</sup> This notion combines the image of the burning of solid materials to ashes with the Aristotelian etymology of *gêras* – *gê* (Earth).<sup>20</sup> For this reason hypothesised cinders (especially of the blood) were later called *particulae terrenae* or *terrestres*, and they are given an important role in explaining old age. According to this theory, ageing has something to do with inadequate ‘burning’ and the accumulation of waste products. Early

<sup>12</sup> Luther Martin, *Der zwelfte und letzte Teil der Bücher des ehrnwürdigen Herrn D. Mart. Luthero. Nemlic. Die erste Auslegung über die Epistel an die Galater/Ecclesiastes oder Prediger Salomo* [...] (Wittenberg, Hans Luftt: 1559) 158 verso. Erasmus Desiderius, *Laus stultitiae* 31, in Erasmus Desiderius, *Ausgewählte Schriften in 8 Bänden*, ed. W. Welzig, 5 vols. (Darmstadt: 1995), vol. 2, 71. Cf. also the early modern etymology of *Senex quasi seminex* (half-dead); cf. Struve Georg Adam, *Tractatus exhibens iura ac privilegia senectutis, Von Freyheiten Alter betagter Leute* (Jena, Ernest. Christian. Rudolph: 1737) 4.

<sup>13</sup> Arist. *Long.* 466b17–19.

<sup>14</sup> Aristoteles, *Problemata* 874b33.

<sup>15</sup> Aristoteles, *De juventute* 470a1; *Resp.* 474b13–24; *De generatione animalium* 784b7f.; *Pr.* 875a4–15. Cf. Niebyl P.H., ‘Old Age, Fever, and the Lamp Metaphor’, *Journal of the History of Medicine and Allied Sciences* 26 (1977) 351–368.

<sup>16</sup> Arist. *GA* 784b8–10; 785a26–30; cf. also *Historia animalium* 518a8–18.

<sup>17</sup> Gabriele Zerbi etymologically traces grey or white hair (*canities*, *canitudo*) to mould (*candor*), which results from humidity and the absence of air. Zerbi Gabriele, *Gabrielis Zerbi Veronensis ad Innocentium VIII. Pon. Max. Gerontocomia* [!] *feliciter incipit* (Rome: 1489), ch. 5 (unpaginated), cf. Zerbi Gabriele, *Gerontocomia. On the Care of the Aged and Maximianus, Elegies on Old Age and Love* (Philadelphia: 1988) 48–49.

<sup>18</sup> Arist. *Pr.* 909b2, 25–27.

<sup>19</sup> Galenus, *In Hippocratis aphorismos commentarii* 14 (17B.410–412 K.).

<sup>20</sup> Arist. *GA* 783b7–8.

iatrochemistry in particular uses this image, which recalls the smelting of ores, and varies it by comparing ageing with the rusting of metal.<sup>21</sup>

Beginning in the mid-seventeenth century, iatrochemical texts also use another image taken from the natural world: that of alcoholic fermentation and the underlying 'ferments'. This can account for physical functions of many different kinds (digestion, menstruation, movement, sensitivity) as well as their corresponding decline in old age. For example, a lack of vitality (*spirituoscentia*)<sup>22</sup> in the blood causes it to appear like spoiled, cloudy wine (*vappa*)<sup>23</sup> and to lose its ability to produce any useful 'spirits' (*spiritus*).

After 1650, another analogy gains great significance in iatromechanical texts on the physiology of ageing, although this one no longer derives from nature: the notion of old age as a kind of malfunction, which follows the Cartesian idea of man as a machine. For example, parts of the *machina hydraulico-pneumatica* are damaged through the wear and tear of constant use and, if there is no possibility of *reparatio*, will cease to function.<sup>24</sup>

These analogies, only very briefly sketched and documented here, are merely the most important ones used in the field of the physiology of old age and ageing. In no way did they replace theoretical presuppositions, which in some cases were directly derived from them, in others were only connected to them, and in others even contradicted them, to some extent. In any case they went far beyond the simple comparison to observed phenomena. We can therefore conclude that, even in the earliest periods, physiology had advanced beyond arguments *ex analogiae*. In the remainder of this chapter I shall illustrate this by means of a few examples, which introduce a range of concepts of the physiology of old age and ageing.

### *Dry or moist? When images and concepts contradict one another*

The analogy between coldness and old age reflected the basic physiological view connecting life to warmth, according to which living beings are

<sup>21</sup> Paracelsus, *Liber de renovatione et restauratione* in Paracelsus Theophrastus, *Werke*, tr. Peuckert W.E., 5 vols (Basel-Stuttgart: 1965–1968), vol. 1, 451.

<sup>22</sup> Camerarius Elias Rudolph – Carolus M. Theodor, *Valetudinarii senilis lineae generales* (Tübingen, Gregorius Kerner: 1683), ch. I, th. 10, 10.

<sup>23</sup> Schrader Friedrich – Blume Johann Heinrich, *Dissertatio medica inauguralis De senectutis praesidiis* (Helmstedt, Georg-Wolfgang Hamm: 1699), § 11 (unpaginated).

<sup>24</sup> E.g. Glagau Aegidius, *Disputatio medica inauguralis De senectute ipsa morbo* (Leiden: 1715), § 4, 8.

endowed at birth with a certain amount of interior or innate warmth (*thermon emphuton*; later *calor innatus*), which constantly diminishes until it has been used up in old age or death.<sup>25</sup> Explaining dryness, on the other hand, was problematic. It is true that, like coldness, it could readily be attributed to the continuous loss of an inner principle, in this case an oily 'vital moisture' (*symphutos hygrotês*, *humor insitus*; later called *humidum radicale*).<sup>26</sup> Old age was therefore considered 'dry' and 'cold' for over two millennia, and texts conflated the collective loss of both vital principles to such a degree that, by the end of the period in which Galenic medicine dominated, often no clear distinction was made between them. For example, Gilbert Fuchs of Liège, personal physician to the Prince Bishop, suggested that exhaling (*exhalatio*) caused a continuous quantitative diminution (*effluvio*) not only of warmth but also of the body's moist substance.<sup>27</sup>

There were clearly problems, however, with integrating 'dry old age' into the slowly developing grand speculative system of the doctrine of temperament. According to this doctrine, man, who is composed of the four elements, contains a different mixture (depending on his age) of the four qualities of cold, warm, dry and moist. Of decisive importance for integrating old age into this comprehensive theory was a further analogy, that between the four seasons and the ages of life, each of which is characterised by two qualities: children were related to spring, the first quarter of the year, the elderly, on the other hand, to winter, being the final quarter.<sup>28</sup> If, as indicated above, one intended to attribute maximum warmth

<sup>25</sup> Hippocrates, *Aphorismi* 1.14 (4.466 L.); Hippocrates, *De natura hominis* 12 (6.64 L.). – The pre-Socratic Parmenides of Elea already supposedly traced the onset of old age to a lack of warmth; following Stobaeus 4.50.2; Hense O. (ed.) *Ioannis Stobaei anthologii libri duo posteriores. Recensuit Otto Hense* (Berlin: 1912), vol. 3, 1032. A brief account of Greco-Roman geriatric medicine is also provided by Horstmanshoff H.F.J., "Alter", in: Leven K.-H. (ed.): *Antike Medizin. Ein Lexikon* (Munich: 2005), col. 32–33; compare also Godderis J., "Peri geros: De antieke geneeskunde over de lichamelijke en psychische kwalen van de oude dag", *Kleio* 18 (1989) 51–66.

<sup>26</sup> Galenus, *De differentiis febrium* 1.10 (7.318 K.); cf. Arist. *Pr.* 875a15; Hall T.S., "Life, Death, and the Radical Moisture", *Clio Medica* 6 (1971) 6–7. On the concept of *humidum radicale* in Avicenna cf. Stolberg M., "Die Lehre vom 'calor innatus' im lateinischen Canon medicinae des Avicenna", *Sudhoffs Archiv* 77 (1993) 39–40; McVaugh M.R., "The 'Humidum Radicale' in Thirteenth-Century Medicine", *Traditio* 30 (1974) 265–266.

<sup>27</sup> Fuchs Gilbert, *Gerocomice, hoc est senes rite educandi modus et ratio* (Cologne, Martinus Gymnicus: 1545). – Girolamo Cardano also mentions the exhalation of *humidum*; Cardano Girolamo, *De sanitate tuenda* 1.8, in Cardano Girolamo, *Opera omnia* (Lyons, J.A. Huguetan and M.A. Ravaut: 1663), vol. VI, 253.

<sup>28</sup> Diogenes Laertius (*De clarorum philosophorum vitis* 8.10) puts this analogy into the mouth of Pythagoras. The Seleucid year, as well as the Roman (until the introduction of the Julian calendar), started in spring (March).

and moisture to children, then for reasons of logic and symmetry summer (youth) had to be warm and dry, and autumn (adulthood) had to be cold and dry, but winter (old age) had to be dry and *moist*.<sup>29</sup> Furthermore, the four humours (*humores*), which are already mentioned in the Hippocratic Corpus and are likewise characterised by qualities – viz. blood (warm/moist), yellow bile (warm/dry), black bile (cold/dry) and phlegm (cold/moist) – are attributed to the four ages in order of preference. Thus, according to this system of humoral physiology or pathology, which dominated Western medicine for more than 1500 years, old age was accorded a cold and moist disposition characterised by phlegm (*phlegma*).<sup>30</sup> In line with this was also the clinical observation, often mentioned in texts, that old people commonly suffer from catarrh, oozing eyes, and similar secretions of moisture.

In various passages of his works, Galen therefore attempted to harmonise this contradiction, which had already become obvious in his day. In his view, the solid parts of the body dry out as a result of the circumstances explained above (continuous loss of *humor insitus*); their environment, though, is too moist, since their insufficient *calor innatus* and resulting weak digestion prevent 'extrinsic' moisture from being absorbed by the 'intrinsic' part of the body.<sup>31</sup> Thus the (excessively) dry, solid parts of the body are confronted with a damaging surplus (*perittômata*; *superfluida*, *excrementa*) of phlegm-like or acrid moisture which, on account of a lack of interior warmth, is poorly digested. In Galen, however, the constitutional basis for ageing remains cold and dry dyscrasia, the unsound mixture of the 'intrinsic'.

Galen's integrative concept of a simultaneously dry and moist old age had an extensive reception over the following 1500 years. An additional, chronologically-based explanation of these contradictory qualities (although one still embedded within the traditional doctrines of temperaments and humours) was provided by a distinction that became common in the High Middle Ages: that between *senectus* as a third and *senium* as a fourth age of life. Before the onset of the 'moist' phlegm of *senium*,

<sup>29</sup> Jean Riolan the Elder, for example, still adheres to this rationale: 'Senectus frigida et humida, ut hyems'; Riolan Jean, *Universae medicinae compendium* (Basel, C. Waldkirch: 1600) 46. An overview of medieval systematics is provided by Burrow J.A., *The Four Ages of Man* (Oxford: 1988) 12–36.

<sup>30</sup> Cf. Schöner E., *Das Viererschema in der antiken Humoralpathologie* (Wiesbaden: 1964) 83, 92.

<sup>31</sup> Galenus, *In Hippocratis librum de natura hominis commentarii* 3.7 (15.185–190 K.); *De temper.* 2.2 (1.580–82 K.).

man is affected in *senectus* by 'dry' black bile (*melan cholê*). Since, in the context of the four-age scheme, Galen does not attribute this black-bile predisposition to actual old age but to the effects of the third age, early modern medicine sometimes also mentions 'melancholic' phenomena and illnesses of old age.<sup>32</sup> In addition to this rough distinction within old age, some early modern authors also point to the significance of individual constitution and temperament of the body and accordingly differentiate between *senectus sanguinea*, *biliosa*, *pituiosa* and *melancholica*. In this scheme, 'cold-dry' melancholics age more quickly than 'warm-moist' sanguine types.<sup>33</sup>

*Why does the flame go out? Disputed conceptions of a deficiency*

Particularly influential for the history of Western medicine and culture was the lamp metaphor already mentioned, used by Aristotle several times in the *Parva naturalia*: as with an oil lamp, the inner flame of a living organism goes out because it lacks fuel, whereupon man dies. This may happen in one of two ways. On the one hand, the flame may be violently blown out (*sbêsis*) when the cold of the surrounding air, which counteracts warmth, makes the 'digestion' of fuel impossible. On the other hand it can be extinguished (*maransis*) for reasons related to old age; in some cases of this kind, a previous lack of cooling can allow an excessive heat to consume the fuel too quickly.<sup>34</sup>

Whereas Aristotle, when introducing the lamp metaphor, does not offer a more detailed characterisation of the lamp's moist, oil-like fuel, Galen expands on the metaphor by fleshing out this very aspect, and it becomes fundamental to his physiology of old age and ageing. He declares the fuel of the flame of life to be 'inner moisture' (*humor insitus*), which is partly

<sup>32</sup> Galenus, *In Hippocratis aphorismos commentarii* 3.30 (17B.645 K.). Cf. the incorporation of concepts of melancholy into the works of Marsilio Ficino, André Du Laurens, Aurelio Anselmi, François de Fougerolles and François Ranchin; see Schäfer, *Old age* ch. 2 (2011). There is a fascinating seventeenth-century depiction of the four ages of life that incorporates many analogies and allegories. As is typical, it associates the last age of life (beginning at forty-nine) with winter and the grave, but also with *melancholia*; compare Horstmannshoff H.F.J. (ed.), *The Four Seasons of Human Life. Four Anonymous Engravings from the Trent Collection* (Rotterdam-Durham: 2002).

<sup>33</sup> E.g. Ranchin François, "GEROKOMIKE: De senum conservatione et senilium morborum curatione", in Ranchin François, *Opuscula medica, publici juris facta, cura et studio H. Gras* (Lyons, P. Ravaut: 1627) 458; cf. also Zerbi, *Gerontocomia*, ch. 7, 61–62.

<sup>34</sup> Cf. Arist. *Long.* 466a30–33; Niebyl, "Old age" 354.



available from the moment of creation on, but partly also accrues as a product of a number of digestive processes. In this respect it is clear that the complete consumption of this sublime moisture by the *calor innatus* amounts to a drying out, even if this process only affects the 'intrinsic' part of the body, its solid organs as well as their formation and nourishment. According to Galen, *calor innatus* is also necessary for the digestive process and for the absorption of moisture by organs, so the body to some extent produces its own fuel. In this way, a gradual reduction of warmth gives rise to an irreversible *circulus vitiosus*. It is Avicenna, however, who is the first to emphasise this process in particular, thereby providing a simple explanation for the inner necessity of natural ageing and death: the consumed moisture becomes increasingly difficult to replace, as the warmth necessary for its production is lacking.<sup>35</sup>

Galen, on the other hand, prefers instead to emphasise external influences on *calor innatus*, such as exterior warmth or air. These could facilitate drying out and, together with the finite amount of inborn *humor insitus*, limit the lifespan. Like Aristotle, Galen too speaks of the consumption of fuel,<sup>36</sup> but in *De marcore* he criticises this simple analogy between a life process and inanimate nature, for *calor innatus* always sustains life.<sup>37</sup> His notion of the influence of 'exterior heat' on the flame of life is also derived from Aristotle, who several times uses the image of one fire being smothered by another as an example of the aforementioned extinction of the warmth of life (*maransis*) from excessive heat.<sup>38</sup> Galen, however, seems to take up this traditional distinction between interior and exterior heat primarily in order to be able to distinguish better between processes that sustain life and those that destroy it.<sup>39</sup> Avicenna goes far beyond Galen with his metaphorical notion that, just as lamp oil can no longer be burned once it has been diluted with water, a surplus of available extrinsic moisture can indirectly extinguish *calor innatus* in the elderly.<sup>40</sup> In the first printed gerocomy (see Fig. 1), however, the Renaissance physician Gabriele Zerbi speaks of a disproportion of *humidum* and *calor*. In the case of

<sup>35</sup> Avicenna, *Canon medicinae* (Venice: 1507) I.3,1, 53 recto; I.1,3,3, 4 recto; cf. Stolberg, "Lehre" 37; Niebyl, "Old age" 359.

<sup>36</sup> Galenus, *De placitis Hippocratis et Platonis* 7.7 (5.703–704 K.).

<sup>37</sup> Galenus, *De marcore* 3 (7.672–676 K.); *In Hipp. Aph. comment.* 14 (17B, 408–409 K.); *De causis pulsuum* 3.6 (9.129 K.); *De methodo medendi* 11.8 (10.753 K.); cf. Niebyl, "Old age" 355.

<sup>38</sup> Aristoteles, *Meteorologica* 379a17–19; cf. also Arist. *Juv.* 469b32–470a4.

<sup>39</sup> Galen, *De mar.* 4 (7.679 K.).

<sup>40</sup> Avicenna, *Canon* I.1,3,3, 4 recto; I.3,1, 53 recto; cf. Stolberg, "Lehre" 37–38.

GABRIELIS ZERBI VERONENSIS  
AD INNOCENTIVM. VIII. PON. MAX.  
GERENTOCOMIA FELICITER INCI-  
PIT. PROLOGVS.

Atquo ac paterno oim fere pſeſu natura ⁊ rōe  
ducente pſeſſus eſt imenſo numine aliquo cūcta  
diſponi cui⁹ nutu ſūmoto tueri ſeipm pōt nſhl. ſ  
numen deus ſiue quolibet nomine appelleſ perfectionis  
ei⁹ exuberantia oīa ſingulis vt decet impartit ⁊ abundā  
tius tribuit etſi ſepenumero ineptitudīe ei⁹ qđ ſubijcīt  
nequeāt adipiſci. Licz autē eſſe ipſum ⁊ viuere diuturnita  
tiſq; vite ⁊ ſalutis appetentia ſicuti ⁊ pſectōes alie a deo  
emanātes rebus nature pſtantibus cōicent nulla bonita  
te que illis cōgruit retenta apud eū in pſimo rex exordio  
Homini tñ vni animantiſ oim meliori (neſcio an dicam)  
ei⁹ ſato ſeu triſtiori adeo imenſam parens natura dedit  
viuendi cupidinē ⁊ locunditatē ei⁹ vite comites indi  
uiduas vt vitā hāc q̄uis temporalis ſit ac labore plenīſſi  
ma tā ſenes q̄ ſaueſes cupiāt ⁊ hī qui miſeri ſunt nolint  
interire etiā cū ſe miſeros eſſe ſentiāt. quo ſit vt hoīm ple  
riq; ſeneſcere cupiant q̄uis ſenectutem accuſent adepti.  
Adeo etiā blanda eſt ſpirandi p ſe cui⁹q; dulcedo vt nemo  
ſit tā ſenex morte etiā in ſoribus deplorare iam vite exſite  
cuilicz interpoſito metu ſpes tñ adhuc annue vite non ſu  
perſit. Nō explet autē cui⁹libet hominis vita quam tan  
topere exoptant periodo equali paucis aut nullis eoz ad  
vltimū hūmane vite finem naturalem imo vix ad ſenectu  
tis pſincipia puenientibus deſidia nō modo ⁊ luxuria bo  
nos mores (vt alim.) viſitantibus quibus humana corpora  
aſſligi pſueuerūt verumetiam accidentibus pluribus atq;  
offenſaculis ſibi oppoſitis interceptibus prius vitā quo

Fig. 1. Gabriele Zerbi, *Gerontocomia* (Rome, Eucharius Silber: 1489). Cover.

excessive warmth it results in premature drying out, but in the opposite case it leads to a putrefaction of inborn moisture.<sup>41</sup>

Nevertheless, the majority of authors assume an accidental cause for the loss of warmth, although they only hint at an explanation. For example, like Avicenna, they mention external factors that could most readily be regulated through diet: food, drink, and air are essential for sustaining the solid, fluid and volatile substances of the body (*solida, humores, spiritus*), but since they are different from man's nature, all of them lead (and increasingly so in old age) to the formation of 'excrements'. These 'excrements' change the body<sup>42</sup> and cause premature ageing and illness if they are not completely eliminated, especially through the bowels, bladder, skin and lungs. Solid food in particular, as an inadequate replacement for *humidum radicale*, will inevitably result in the accumulation of cinders (*partes terrestres*): the flame dies because the quality of its fuel declines excessively. That is why, according to Cardano, everything conducive to the ingestion of food is detrimental to a long life.<sup>43</sup>

Jean Fernel also struggles with Galen's contradictory position on the cause of old age. On the one hand, the shift of temperament towards coldness and dryness is supposedly not the result of external influences such as heat or immoderate living; rather it is due to internal causes, namely interior warmth, which depletes itself through the consumption of its own fuel. On the other hand, this process does not happen of its own accord (*per se*), since warmth naturally tends to conserve itself, but rather is brought about accidentally.<sup>44</sup> Admittedly, Fernel does not explain this Galenic paradox in greater detail.

### *Can warmth and moisture be restored?*

This question is closely connected to that of the causes of the increasing decline of internal processes of life, and it extends it to include the

<sup>41</sup> Zerbi, *Gerontokomia* ch. 2, 35.

<sup>42</sup> Du Laurens André (Laurentius Andreas), *A Discourse of the Preservation of the Sight, of Melancholike Diseases, of Rheumes, and of Old Age*, tr. Surphlet R. (London, Jacson: 1599) 172.

<sup>43</sup> Cardano Girolamo, "De sanitate tuenda" 1.8, in Cardano, *Opera*, vol. VI, 34.

<sup>44</sup> Fernel Jean, *Jo. Fernelii Universa medicina... postea autem studio et diligentia Gul. Plantii postremo elimata* [...] Ed. tertia (Frankfurt, A. Wechel: 1575), *Physiologia* 4,8 ('Ut innatum calidum aetatum inclinatione status mutationem subeat') 158.

discussions of rejuvenation, longevity, and immortality that flourished particularly during the Renaissance.

Aristotle already posits a close connection between warmth, semen and pneuma (*spiritus*), the last being for him an analogue to eternal *aether*, the heavenly element.<sup>45</sup> This hypothesis prompted medieval and early modern medicine to question the transience and supposedly inevitable extinction of *calor innatus*. In a treatise by Jean Fernel<sup>46</sup> harshly criticised in Anselmi's *gerocomy*, we read of a *calor caelestis*: an internal warmth characterised by a 'heavenly' (in the Aristotelian sense) eternal nature that makes it incapable of exhausting itself. François Fougerolles [Fig. 2] also claims that this 'heavenly' element – as a materialised, ethereal *instrumentum* of the immortal soul – is in principle eternal.<sup>47</sup> According to other authors, internal warmth, like all transitory things, is composed of a variety of elements (*calor mixtus*).

On the question of the fuel for the flame, Islamic<sup>48</sup> and learned Western medicine in the Middle Ages also discuss the similarity between, and even the identity of, vital *humidum radicale* and seminal moisture (*humidum spermaticum*). Around 1300, in authors such as Arnald of Villanova and Bernard de Gordon, this leads to the question of whether the amount of this essential moisture, and thus also that of semen (in the sense of a body-forming material), is determined at birth. Or might it not be possible, in a way analogous to visible semen, which is supplied again and again in the *spermificatio* for the purpose of procreation, for it to be reproduced from the blood by means of food, as a high-quality product of the final stage of the digestive process?<sup>49</sup> In principle, *humidum radicale*'s origin from semen (*humidum primigenium*) makes it impossible to replace.<sup>50</sup> However, if not replaced, this moisture will be consumed after a short time. A *reparatio* of *humidum* is therefore necessary. As mentioned above, this occurs through the taking up of additional moisture, whereby

<sup>45</sup> Arist. GA 736b34–36.

<sup>46</sup> Fernel Jean, *De abditis rerum causis libri duo* (Hanover: 1610<sup>6</sup>) 2,7–8, 85–93; cf. Anselmi, *Gerocomica* 26–27.

<sup>47</sup> Fougerolles François de, *De senum affectibus praecavendis nonnullisque curandis enarratio* (Lyons, I. de Gabiano and L. Durand: 1617) 22 (diagram of the working of *Calor insitus*).

<sup>48</sup> Avicenna, *Canon* III.20,1,3,352 recto: sperm contains *humiditates radicales* and *calor innatus*; it develops from fourth digestion, as a surplus within various organs (so called 'pan-genetic' aetiology). See McVaugh, "Humidum Radicale" 265–268.

<sup>49</sup> McVaugh, "Humidum Radicale" 279–281.

<sup>50</sup> Brisiani Girolamo, *Geraeologia ad serenissimum Ferdinandum Archiducem Austriae etc.* (Trent, I. Baptista and J. Fratres de Gelminis de Sabbio: 1585) 21 recto–23 recto.

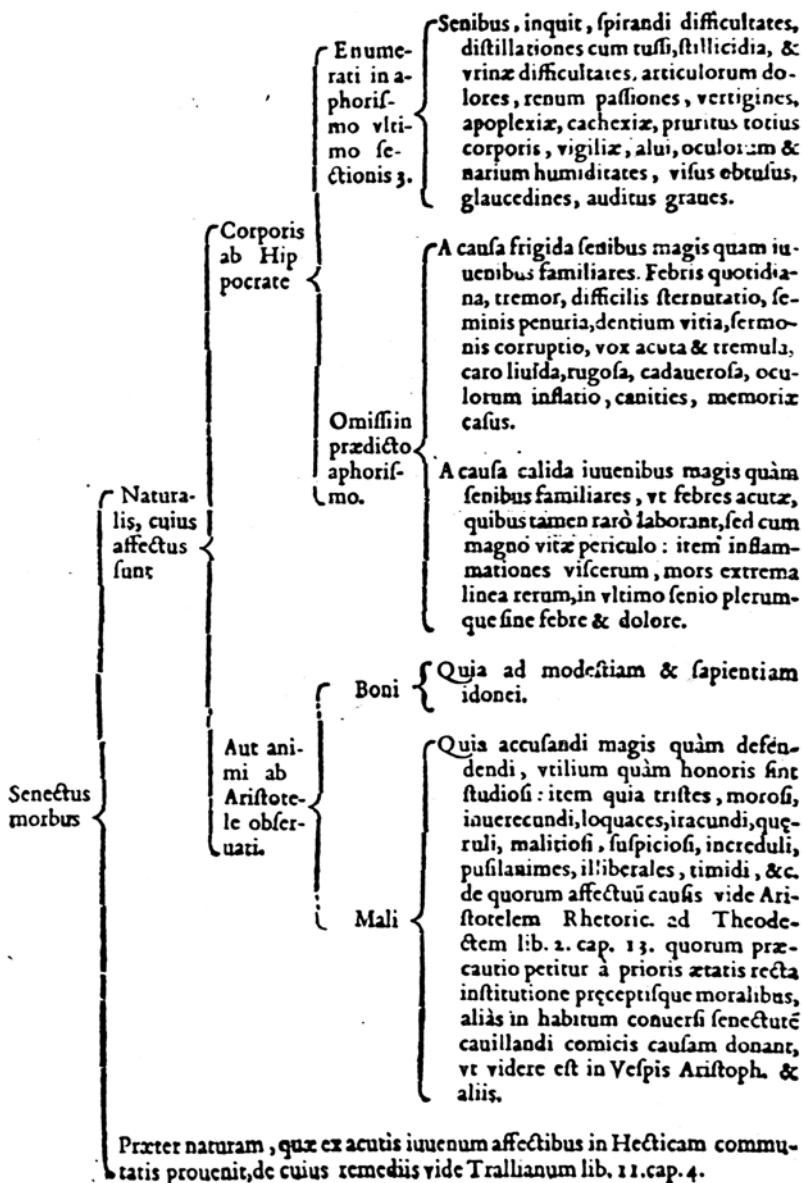


Fig. 2. The physiology and pathology of age and ageing, from François de Fougerolles, *De senum affectibus præcavendis nonnullisque curandis enarratio* (Lyons, Ian. de Gabiano and Laur. Durand: 1617).

food is transformed (*mutatio*) over the course of the various stages of digestion into *humidum alimentum*, and thus continued life and growth are made possible.

But is it also possible to continuously restore (*restauratio perpetua*) what has been consumed? On this point opinions differ. For example, Laurent Joubert believes a *reparatio* and *restauratio* of *calor* and *humidum* to be possible by means of the right 'moist' food (i.e. a certain diet): in this way, the empty spaces and pores in the tissue are filled with nutritive *humor* in order to slow the consumption of *humidum radicale*, just as oil in a lamp is diluted to reduce its natural heat.<sup>51</sup> Alchemical healers, too, think that life principles of any kind can be renewed by means of purification, transmutating *arcana*, etc.<sup>52</sup> Nevertheless, most early modern physicians and philosophers with a university background reject this, for several reasons.

The Spanish physician and philosopher Francesco de Valles, for example, emphasises fundamental objections (and thus the limits of analogy): why can fire burn incessantly as long as there is enough fuel, but man cannot? The difference lies not in the material but in the formal nature of food: in contrast to inanimate things, living beings need their food to be transformed into pre-existing forms (*praeexistentes*) that must be preserved and increased; fire, on the other hand, is constantly generated anew by simple alteration (*alteratio*). The process of transformation may result in a limitation of lifespan. Imagined as an (internal) motion (*motus*) aimed at restoring bodily substance, its effect is slower than that of external processes on the body and, furthermore, (in the context of digestion) is dependent on bodily resources. It is therefore basically impossible for moistening food to balance out a loss of moisture resulting from external influence, and that is why the body ultimately dries out.<sup>53</sup> Aurelio Anselmi, a physician from Mantua, rejects this 'physical' explanation. Instead he favours a traditional rationale that places blame on the composition of food: drying out results from a growing accumulation of the indigestible *partes terrestres*<sup>54</sup> originally found in food, as well as from a weakness

<sup>51</sup> Joubert Laurent, *Erreurs populaires au fait de la médecine et régime de santé* (Bordeaux, Millanges: 1578) 1, 2.

<sup>52</sup> Cf. the account in: Schäfer, *Old Age*, ch. 2,3,3.

<sup>53</sup> Vallés Francisco de, *De iis, quae scripta sunt physice in libris sacris, sive de sacra philosophia liber singularis* (Lyons, Q. Hug. a Porta, Fratres de Gabiano: 1592), ch. 6, 107–115.

<sup>54</sup> Ficino and Cardano also call them *faeces*; Ficino, Marsilio, *Three Books of Life [De vita]*, trs/ann. Kaske C.V. – Clark J.R. (Tempe Arizona: 1998<sup>2</sup>), vol. II, 3, 170; Cardano, "De sanitate tuenda" 4.1, in Cardano, *Opera*, vol. VI, 242.



of those parts of the body (*membra*) where this process of digestion and transformation takes place.<sup>55</sup> To that effect, Fougerolles emphasises that the necessary contact with a foreign substance (*aliena*) generates a mud-like sludge (*crassamentum terreum*).<sup>56</sup> In Du Laurens' view too, the original semen is cleaner than the nourishing blood. Pollution is only one factor, though; crucial also is the 'dilution' and weakening of the original *humidum* due to inadequate replenishment.<sup>57</sup> In his *Universal Medicine*, Jean Riolan himself takes up the debate on the renewability of *humidum radicale* and emphasises that it is impossible for warmth to be restored by the same process that leads to its consumption: vital moisture is nothing other than the oily-airy part of semen, which exists in the solid parts of the body and cannot be renewed.<sup>58</sup>

This academic debate on the restoration of vital substance belongs to the context of contemporary speculation on longevity and the retardation of ageing; however, it also influenced early modern dietetics.

### *Is natural ageing a (fever-related) illness?*

As mentioned above, Galen used an analogy between the drying out that results from (hectic) fever, which leads to premature, illness-related senescence (*geras ek nosou*; *senium ex morbo*), and 'dry' old age. This comparison was intended to illustrate the state of emaciation in the elderly as well as the difficulties of their medical treatment.<sup>59</sup> Nevertheless, Galen vehemently resisted the equation of old age and illness that was apparently common among his contemporaries.<sup>60</sup> The latter could point to unclear passages in the work of Aristotle, according to which an ebbing of strength (*adynamia*) – like old age or pathological consumption (*phthisis*) – is a process against nature (*para phusin*).<sup>61</sup> His observation of the reversible greying of hair in cases of (fever-related) illnesses even led Aristotle to

<sup>55</sup> Anselmi, *Gerocomica* 37–50.

<sup>56</sup> Fougerolles, *De senum* 19–20.

<sup>57</sup> Du Laurens, *Discourse* 170.

<sup>58</sup> Riolan, *Universae medicinae* 63 (*Physiologia* 3,1).

<sup>59</sup> Galen, *De meth. med.* 10.11 (10.730 K.); *De mar.* 4 (7.677–681 K.). Cf. Niebyl, "Old age" 357.

<sup>60</sup> Galen, *De mar.* 2 (7.669–670 K.).

<sup>61</sup> Aristoteles, *De caelo* 288b15–20. According to ancient and medieval notions, illnesses are unnatural events (*res praeternaturales*).



propose a bold thesis: illness is nothing other than acquired old age, but old age is a natural illness (*nosos physikê*).<sup>62</sup>

In his *Canon*, Avicenna also treats marasmic fever and the involution of old age as different processes stemming from different causes (external and internal warmth, respectively). In the case of marasmus, the 'external' heat of the fever – relative to the severity of the illness – increasingly consumes the 'secondary moistures' (*humiditates radicales*, among others) that are created at the various stages of digestion. The Muslim author compares them to various parts of a lamp wick (but not to the lamp's oil!). The 'radical moistures' in Avicenna should probably not be seen as identical to Galen's *humor insitus*.<sup>63</sup> In the aftermath, however, the subtle differences between pathological marasmus and physiological ageing come close to melding into one, as in most cases the same basic substance (*humidum radicale*) is hypothesised for both, and the same lamp metaphor is employed again and again in comparisons.

Galenism seeks to evade the danger of muddying the two concepts by stubbornly emphasising their differences. Accordingly, late medieval medicine uses the same name for *senium ex morbo*<sup>64</sup> and hectic fever (*marasmodes*), whereas old age is obviously given this title (*marasmodes per etates senectutis*) only in the figurative sense (*transsumptive*).<sup>65</sup> Early modern medicine also receives marasmus initially as a discrete illness and only occasionally mentions the parallel to natural old age in this context. Only in the eighteenth century is old age regularly referred to as natural or senile marasmus, sometimes also with a fever pathology ascribed to it.<sup>66</sup> Accordingly, physicians of this time no longer contradict the popular saying that old age is itself an illness (*senectus ipsa morbus*) [Fig. 3]; instead it serves as an illustration of the newly developed iatromechanical pathophysiology according to which, from birth onwards, man's machine-body is constantly changing and is inevitably driven towards a state of

<sup>62</sup> Arist. GA 784b33–34. Cf. Galen, *De san. tuenda* 6.2 (6.388 K.).

<sup>63</sup> Stolberg, "Lehre" 39–40.

<sup>64</sup> On *senium ex morbo* cf. Du Cange, *Glossarium mediae et infimae latinitatis* (Graz: 1954), vol. 4, 258 ('marasmodes ex aegritudine senectus', in Gloss. ad Alex. Iatrosoph. MS. Lib. 2 Passion. ch. 38).

<sup>65</sup> Demaitre L., "The Medical Notion of 'Withering' from Galen to the Fourteenth Century: The Treatise on Marasmus by Bernard of Gordon", *Traditio* 47 (1992) 259–307, 298, 300; see also Demaitre L., "The Care and Extension of Old Age in Medieval Medicine", in Sheehan M.M. (ed.), *Ageing and the Aged in Medieval Europe* (Toronto: 1990) 3–22.

<sup>66</sup> Some university writings are dedicated specifically to this concept; cf. Schäfer D., "That Senescence Itself is an Illness . . ." Concepts of Age and Ageing in Perspective", *Medical History* 46 (2002) 525–548.

JACOBI HVTTER,  
 MED. DOCT.  
 TRACTATIO MEDICA  
 QVA  
**SENECTVS**  
**IPSA MORBVS**  
**SISTITVR**

Daß ist:

Daß das Alter an und vor sich selbst eine  
 Krankheit seye.




---

HALÆ MAGDEBURGICÆ, 1732.

Typis IO. CHRISTIANI HILLIGERI, Acad. Typogr.

Fig. 3. Reprint of Jacob Hutter's dissertation/thesis (Halle, Christian Hilliger: 1732). Title page.

malfunction by movement, adjustment, and wear and tear. That this worn-out condition is described as 'ill' and no longer as 'natural' is due to the conception of illness of the period, which now favours the opposition between health and illness instead of the ancient one between nature and illness: whereas old age had earlier been located within a broad spectrum of natural phenomena between healthy and ill, in the eighteenth century, when this spectrum was increasingly negated, it temporarily became a 'pathological' state, without anything having changed in its prognosis or therapy. But, around 1800, holistic concepts of a physiology of old age increasingly gave way to the study of particular illnesses (a 'special pathology' of old age); and with that the traditional analogies of old age were also largely replaced.

*New heuristic approaches. Physiological knowledge from Observationes and Experimenta*

Of course, in addition to the central concept of diminishing *calor* or *humidum*, there were many competing ideas about the physiology of age and ageing. For example, Plato's *Timaeus*<sup>67</sup> was the source for the idea that a discordance between the elements (fire, water, air, and earth) was a factor in causing old age; this was taken up especially by the medical school of Montpellier (André du Laurens, Francois Ranchin). Another competing notion cited not only the loss of warmth and moisture, but also the more general loss of any kind of bodily substance (*solida, humores, spiritus*). As for external causes, the influence of the stars was considered by some to be as pernicious as errors in diet (in the broadest sense).

But, around 1600, new heuristic methods begin to penetrate the science of physiology and therefore also the realm of proto-gerontology. Francis Bacon admittedly continues, in his *Historia vitae et mortis* (1623),<sup>68</sup> down the Aristotelian path of induction; that is, the attempt to proceed from particular examples of longevity to general knowledge about the ageing processes and the potential for a long life.<sup>69</sup> Nevertheless, he clearly broadens

<sup>67</sup> Plato, *Timaeus* 81d; cf. also Pl. *Ti.* 32c–33a; 53c–55c.

<sup>68</sup> Text in: Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 14 vols. (London: 1858–1874) (repr. (Stuttgart-Bad Cannstatt: 1963)), vol. II, 101–226.

<sup>69</sup> Cf. Schäfer D., "Gullivers Greise und Medeas Mixturen: Frühneuzeitliche Beispiele für Langlebigkeit im medizinischen und nichtmedizinischen Kontext", in: Gadebusch

this method by bringing a previously unheard-of number of examples to bear (principle of accumulation) and by consciously taking counterexamples into consideration (principle of falsification). In this way he makes the nature of ageing into a subject to be studied as objectively as possible. This approach excludes presuppositions that are in effect speculative, such as those facilitated by analogies. Even Bacon's treatise, however, contains highly speculative considerations, influenced by Neoplatonism, that run counter to his proposed method. And Bacon himself uses so-called *scientific analogies* (*scientiae analogia*) as heuristic categories when sensory knowledge is wanting.<sup>70</sup> For example, his *Historia vitae et mortis* contains the traditional allusion to flame-like *spiritus*, which must be restrained in order to keep from being consumed too quickly.<sup>71</sup>

Nevertheless, a glance at late-seventeenth- and eighteenth-century dissertation theses shows progress, despite many run-of-the-mill studies, in amassing 'objective knowledge' about old age. Short, vague *exempla* are increasingly replaced by clinical *observations*,<sup>72</sup> although their significance is often overstated and wrongly generalised. Cumulative analyses continue to be rare, but epidemiological figures are published with increasing frequency. One example is the London *Bills of Mortality* [Fig. 4], which also list the number of deaths due to old age.<sup>73</sup> Statistical analyses are already being used sporadically to refute the Aristotelian hypothesis that men live longer than women,<sup>74</sup> or the existence of climacteric years with a

---

Bondio M. – Ricklin T. (eds.), *Exempla medicorum – Die Ärzte und ihre Beispiele* (14.–18. Jahrhundert) (Florence: 2008) 219–228.

<sup>70</sup> Cf. Zittel C., "‘Truth is the Daughter of Time’: Zum Verhältnis von Theorie der Wissenskultur, Wissensideal und Wissensordnungen bei Bacon", in Detel W. – Zittel C. (eds.), *Ideals and Cultures of Knowledge in Early Modern Europe/Wissensideale und Wissenskulturen in der frühen Neuzeit. Concepts, Methods, Historical Conditions and Social Impact* (Berlin: 2002) 227.

<sup>71</sup> Bacon, *Works*, vol. II, 106.

<sup>72</sup> E.g. Roy Hendrik de – Beeck Adrian, *Medicatio senis vertiginosi* (Utrecht, P.D. Sloot: 1645); Coschwitz Georg Daniel – Hagenbuch Johann Heinrich, *Dissertatione inaugurali medico-chirurgica De sphacelo senum* (Halle, J.C. Hilliger: 1725).

<sup>73</sup> Cf. Graunt John, *Natural and political observations made upon the Bills of Mortality* (London, Roycroft: 1662), Table "The Table of Casualties", after 76 [repr. *Pioneers of demography, The earliest classics*. With an introduction by Peter Laslett (Westmead: 1973)].

<sup>74</sup> Gessner Johannes – Ochsner Jacobus – Schmid Jacob – Dänzler Rudolf, *Dissertatio physico-medico-mathematica De termino vitae* (Zürich, Gessner: 1748), § 13, 25–26 (sources u.a. London *Bills of Mortality*; cf. § 8, 12). In particular, the theologian and statistician Süßmilch deals with this question and achieves clear results; Süßmilch Johann Peter, *Die göttliche Ordnung in denen Veränderungen des menschlichen Geschlechts, aus der Geburt, dem Tode und der Fortpflanzung desselben erwiesen*. 3 vols. (Berlin, Verlag der Buchhandlung der Realschule: 1765–1776<sup>3</sup>), vol. II (1765), §§ 477–480, 348–352.

# The Diseases and Casualties this Week.

<b>A</b> Bortive	5
Aged	43
Ague	2
Apoplexie	1
Bleeding	2
Burnt in his Bed by a Candle at St. Giles Cripplegate	1
Canker	1
Childbed	42
Chrisomes	18
Consumption	134
Convulsion	64
Cough	2
Dropic	33
Feaver	309
Flox and Small-pox	5
Frighted	3
Gowt	1
Grief	3
Gripping in the Guts	51

Jaundies	5
Imposthume	11
Infants	16
Killed by a fall from the Bell- frey at Alhallowes the Great	1
Kingsevil	2
Lethargy	1
Pallie	1
Plague	7165
Rickets	17
Rising of the Lights	11
Scowring	5
Scurvy	2
Spleen	1
Spotted Feaver	101
Stillborn	17
Stone	2
Stopping of the Stomach	9
Strangury	1
Suddenly	1
Surfeit	49
Teeth	121
Thrush	5
Timpany	1
Tifick	11
Vomiting	3
Winde	3
Wormes	15

Christned	Males	95
	Females	81
	In all	176

Buried	Males	4095
	Females	4202
	In all	8297

Plague-7165

Increased in the Burials this Week

607

Parishes clear of the Plague

4 Parishes Infected

128

*The Afixe of Bread set forth by Order of the Lord Mayor and Court of Aldermen,  
A penny Wheaten Loaf to contain Nine Ounces and a half, and three  
half-penny White Loaves the like weight.*

Fig. 4. Bills of Mortality, London 1666  
(from <http://www.slough.org/content/410265/>).

particularly high rate of death.<sup>75</sup> Furthermore, authors estimate the actual share of the population at large represented by the elderly,<sup>76</sup> and in so doing they question the concept of natural old age and death, as almost all people die of identifiable illnesses.<sup>77</sup> The latter insight is increasingly supported by autopsy reports on the elderly; these are admittedly rare – if nothing else because of the smaller number of deaths and executions among the elderly – but they are almost routinely employed to substantiate iatromechanical physiology and the pathology of old age. The findings of microscopy and the vascular injections pioneered by Ruysch [Fig. 5] have great significance for the development of the iatromechanical theory of ageing.<sup>78</sup> In a very few instances, animal experiments are also used to provide evidence for particular physiological questions.<sup>79</sup>

*Conclusion. What significance do analogies have for  
physiological concepts?*

This cursory glance at physiological conceptions of old age and ageing over the past 2500 years shows that analogies to natural or cultural processes regularly served as the (inductive) starting point for, or at least as confirmation of, medical concepts. In particular, the image of the fading lamp definitively influenced Western thought until the end of the eighteenth century.<sup>80</sup> Analogies were therefore decisive for early gerontology

---

<sup>75</sup> Gessner – Ochsner – Schmid – Dänzler, *De termino* § 10, 18 and table in the appendix (unpaginated). Furthermore, Gessner et alii give statistical evidence for the high rate of child mortality, provide probability calculations for the survival of married couples (§ 10, 19–20), and show that married people statistically live longer than those who are unmarried (§ 13, 26).

<sup>76</sup> Gessner – Ochsner – Schmid – Dänzler, *De termino* § 12, 24; according to this study, ten out of every eighty-six people (=11.6 % of the population) are older than fifty-six.

<sup>77</sup> Gessner – Ochsner – Schmid – Dänzler, *De termino* § 13, 27. – Cf. also Hoffmann Friedrich – Blüdnor Christian, “De generatione mortis in morbis”, in Hoffmann Friedrich, *Opera omnia physico-medica*, 6 vols. (Geneva, Tournes: 1740) VI, 244–250, § 33, 250; Seiler Burkhard Wilhelm, *Anatomiae corporis humani senilis specimen* (Erlangen, Hilpert: 1799) XVII–XVIII.

<sup>78</sup> See the numerous explanations in Ruysch Frederik, *Thesaurus anatomicus* (Amsterdam, J. Wolters: 1701).

<sup>79</sup> Schrader – Blume, *De senectutis* § 9 (unpaginated); Zwinger Theodor [Junior], *Unter-richt, ein hohes Alter zu erlangen [...]* (*De aquirenda vitae longaevitate dt.*) (Nordhausen, Joh. Heinrich Groß: 1726), ch. I, 17, 27.

<sup>80</sup> Daniel Wilhelm Triller is still using Galenistic arguments for dietetic restraint at the end of the eighteenth century, as can be seen in the following verses: ‘Soll eine Lampe lange brennen; Ist ihr nur mäßig, Oel zu gönnen, Weil sie durch dessen Ueberfluß, sonst



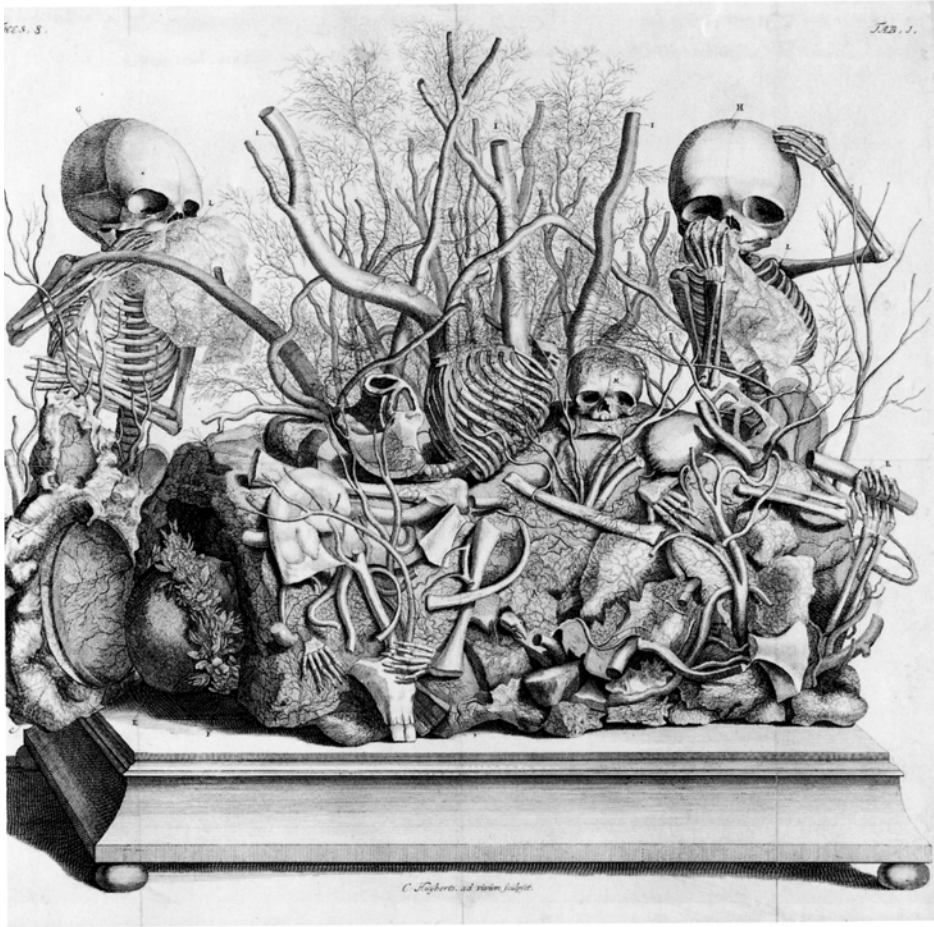


Fig. 5. 'Diorama' of foetus with vascular preparations etc., from Frederik Ruysch, *Thesaurus anatomicus octavus. Het achtste anatomisch cabinet van Frederic Ruysch* (Amsterdam, Joannes Wolters: 1709).



and geriatrics, although their uncritical equation of natural processes beyond the original parameters of analogy also facilitated the persistence of speculative theories. Nevertheless, a close look at textual sources – here only possible in a few discrete cases – shows that many authors dealt creatively and productively with such images, discussing them extensively and arguing about matters of detail. Concepts like the flame that generates its own fuel or the irreplaceable *humidum* clearly went beyond the mere interpretation of images. The successive replacement of analogies by ‘objective’ methods, whose cumulative observations and statistical evaluations proved particularly effective in falsifying previous assumptions, brought new insights to the physiology of old age.

Nevertheless, even today analogies continue to play an important role. At the molecular and genetic levels, modern theories of old age and ageing still discuss environmental factors, toxicity, decline, and wear and tear, and, at least in popular science texts, they still employ analogies: oxygen radicals are described as being ‘extremely reactive’, and DNA changes in mitochondria induce a genetic ‘suicide programme’ (apoptosis). But such images generally denote secondary processes that are articulated only as illustrations of established theories. Analogies from nature continue to be productive in the realm of technological developments (e.g. aircraft construction; lotus blossom effect); for the development of theories, however, they have outlived their usefulness.

---

allzufrüh verlöschen muß’; Triller Daniel Wilhelm, *Daniel Wilhelm Trillers diätetische Lebensregeln oder Belehrung wie es anzufangen ein hohes Alter zu erlangen. In dessen Sieben und Achtzigsten Jahre aufgesetzt* (Frankfurt-Leipzig, Johann Georg Fleischer: 1783) 12.

*Selective bibliography*

- ANSELMUS AURELIUS, *Gerocomica sive de senum regimine. Opus non modo philosophis et medicis gratum, sed omnibus hominibus utile* (Venice, Franciscus Ciottus: 1606).
- BURROW J.A., *The Four Ages of Man* (Oxford: 1988).
- BRISIANI GIROLAMO, *Geracologia ad serenissimum Ferdinandum Archiducem Austriae etc.* (Trent, I. Baptista and J. Fratres de Gelminis de Sabbio: 1585).
- BYL S., "La gérontologie de Galien", *History and Philosophy of the Life Sciences* 10 (1988) 73–92.
- CAMERARIUS ELIAS RUDOLPH – CAROLUS M. THEODOR, *Valetudinarii senilis lineae generales* (Tübingen, Gregorius Kerner: 1683).
- CARDANO GIROLAMO, *Opera omnia*, 10 vols. (Lyon, J.A. Huguetan and M.A. Rauaud: 1663).
- COSCHWITZ GEORG DANIEL – HAGENBUCH JOHANN HEINRICH, *Dissertatione inaugurali medico-chirurgica De sphacelo senum* (Halle, J.C. Hilliger: 1725).
- DEMAITRE L., "The Care and Extension of Old Age in Medieval Medicine", in Sheehan M.M. (ed.), *Ageing and the Aged in Medieval Europe* (Toronto: 1990) 3–22.
- , "The Medical Notion of 'Withering' from Galen to the Fourteenth Century: The Treatise on Marasmus by Bernard of Gordon", *Traditio* 47 (1992) 259–307.
- FERNEL JEAN, *Jo. Fernelii Universa medicina . . . , postea autem studio et diligentia Gul. Plantii postremo elimata* [...] (Frankfurt, A. Wechel: 1575<sup>3</sup>).
- FOUGEROLLES FRANÇOIS DE, *De senum affectibus praecavendis nonnullisque curandis enarratio* (Lyons, I. de Gabiano and L. Durand: 1617).
- FUCHS GILBERT, *Gerocomice, hoc est senes rite educandi modus et ratio* (Cologne, Martinus Gymnicus: 1545).
- GESSNER, JOHANNES – OCHSNER JACOBUS – SCHMID JACOB – DÄNZLER RUDOLF, *Dissertatio physico-medico-mathematica De termino vitae* (Zürich, Gessner: 1748).
- GLAGAU AEGIDIUS, *Disputatio medica inauguralis De senectute ipsa morbo* (Leiden: 1715).
- GODDERIS J., "Peri geros: De antieke geneeskunde over de lichamelijke en psychische kwalen van de oude dag", *Kleio* 18 (1989) 51–66.
- GRMEK M.D., *On Ageing and Old Age. Basic Problems and Historic Aspects of Gerontology and Geriatrics*, Monographiae biologicae V, 2 (The Hague: 1958).
- HALL THOMAS S., "Life, Death, and the Radical Moisture", *Clio medica* 6 (1971) 3–23.
- HOFFMANN FRIEDRICH – BLÜDORN CHRISTIAN, "De generatione mortis in morbis", in Hoffmann Friedrich, *Opera omnia physico-medica*, 6 vols. (Geneva, Tournes: 1740).
- HORSTMANSHOFF H.F.J., "Alter", in Leven K.-H. (ed.), *Antike Medizin. Ein Lexikon* (Munich: 2005), col. 32–33.
- , (ed.), *The Four Seasons of Human Life. Four Anonymous Engravings from the Trent Collection* (Rotterdam-Durham: 2002).
- LAURENS ANDRÉ DU (Laurentius Andreas), *A Discourse of the Preservation of the Sight, of Melancholike Diseases, of Rheumes, and of Old Age*, tr. Surphlet R. (London, Jacson: 1599).
- MCVAUGH M.R., "The 'Humidum Radicale' in Thirteenth-Century Medicine", *Traditio* 30 (1974) 259–283.
- NIEBYL P.H., "Old Age, Fever, and the Lamp Metaphor", *Journal of the History of Medicine and Allied Sciences* 26 (1977) 351–368.
- PARACELSUS THEOPHRASTUS, *Werke*, tr. Peuckert W.E., 5 vols (Basel-Stuttgart: 1965–1968).
- RANCHIN FRANÇOIS, "GEROKOMIKE: De senum conservatione et senilium morborum curatione", in Ranchin François, *Opuscula medica*, publici juris facta, cura et studio H. Gras (Lyons, P. Ravaud: 1627) 456–592.
- RIOLAN JEAN, *Universae medicinae compendium* (Basel, C. Waldkirch: 1600).
- ROTHSCHUH K.E., *Physiologie. Der Wandel ihrer Konzepte, Probleme und Methoden vom 16. bis 19. Jahrhundert* (Freiburg-Munich: 1968).
- ROY HENDRIK DE – BEECK ADRIAN, *Medicatio senis vertiginosi* (Utrecht, P.D. Sloot: 1645).

- RUYSCH FREDRIK, *Thesaurus anatomicus* (Amsterdam, J. Wolters: 1701).
- SCHÄFER D., "Gullivers Greise und Medeas Mixturen. Frühneuzeitliche Beispiele für Langlebigkeit im medizinischen und nichtmedizinischen Kontext", in: Gadebusch Bondio M. – Ricklin T. (eds.), *Exempla medicorum – Die Ärzte und ihre Beispiele (14.–18. Jahrhundert)*, Micrologus' Library 26 (Florence: 2008) 219–228.
- , *Old Age and Disease in Early Modern Medicine* (London: 2011).
- , "That Senescence Itself is an Illness . . .: Concepts of Age and Ageing in Perspective", *Medical History* 46 (2002) 525–548.
- SCHRADER FRIEDRICH – BLUME JOHANN HEINRICH, *Dissertatio medica inauguralis De senectutis praesidiis* (Helmstedt, Georg-Wolfgang Hamm: 1699).
- SEILER BURKHARD WILHELM, *Anatomiae corporis humani senilis specimen* (Erlangen, Hilpert: 1799).
- STOLBERG M., "Die Lehre vom 'calor innatus' im lateinischen Canon medicinae des Avicenna", *Sudhoffs Archiv* 77 (1993) 33–53.
- SÜßMILCH JOHANN PETER, *Die göttliche Ordnung in denen Veränderungen des menschlichen Geschlechts, aus der Geburt, dem Tode und der Fortpflanzung desselben erwiesen*. 3 vols. (Berlin, Verlag der Buchhandlung der Realschule: 1765–1776<sup>a</sup>).
- TRILLER DANIEL WILHELM, *Daniel Wilhelm Trillers diätetische Lebensregeln oder Belehrung wie es anzufangen ein hohes Alter zu erlangen. In dessen Sieben und Achtzigsten Jahre aufgesetzt* (Frankfurt-Leipzig, Johann Georg Fleischer: 1783).
- VALLÉS FRANCISCO DE, *De iis, quae scripta sunt physice in libris sacris, sive de sacra philosophia liber singularis* (Lyons, Q. Hug. a Porta, Fratres de Gabiano: 1592).
- ZERBI GABRIELE, *Gerontocomia. On the Care of the Aged and Maximianus, Elegies on Old Age and Love*, tr. Lind L.R. (Philadelphia: 1988).
- ZITTEL C., "Truth is the Daughter of Time': Zum Verhältnis von Theorie der Wissenskultur, Wissensideal und Wissensordnungen bei Bacon", in Detel W. – Zittel C. (eds.), *Ideals and Cultures of Knowledge in Early Modern Europe/Wissensideale und Wissenskulturen in der frühen Neuzeit. Concepts, Methods, Historical Conditions and Social Impact* (Berlin: 2002) 213–235.
- ZWINGER THEODOR [JUNIOR], *Unterricht, ein hohes Alter zu erlangen [...]* (*De aquirenda vitae longaevitate*) (Nordhausen, Joh. Heinrich Groß: 1726).

# SUFFERING BODIES, SENSIBLE ARTISTS. VITALIST MEDICINE AND THE VISUALISING OF CORPOREAL LIFE IN DIDEROT

Tomas Macsotay

## *Summary\**

This contribution examines, within the framework of French eighteenth-century philosophical materialism, the physiological theory to be found in a selection of aesthetic writings by Diderot. In outlining the medico-physiological outlook encapsulated in these writings, two historical perspectives are developed. The first pertains to Diderot's championing of the school of Montpellier and vitalism, while the second emerges from Diderot's concentration on body images as potential objects in aesthetic experience. This focus on the human figure is already present in a body of theoretical writings from the Paris *Académie royale de peinture et de sculpture*, where a form of 'diagnosis' of lifelike corporeal images is effective almost immediately after this institution's establishment. By a series of correspondences with practices in artists' Academies and Montpellier medicine, Diderot's writings offer a unique opportunity to broach perceptive (dis)continuities caused by the advent of a novel medico-physiological outlook on life.

## *Introduction*

The infusion of medical ideas in eighteenth-century cultural life poses many challenges to students of the arts. Following the impact of Oskar Kristeller's "The system of the arts" and the postulate that, during the Enlightenment, the arts and sciences were severed by a new, permanent divide, some art historians have suggested that medicine was becoming too complex for artists (and their audiences), who were unable to cope with its newest notions.<sup>1</sup> By contrast, literary historians have assembled

---

\* The author wishes to thank the Henry Moore Foundation for its financial support and Valerie Mainz for her encouragement and valuable suggestions. Russell Goulbourne kindly corrected the translations of a number of the cited passages.

<sup>1</sup> Kristeller P.O., "The Modern System of the Arts", in Kristeller P.O. (ed.), *Renaissance Thought, Papers on Humanism and the Arts* (New York: 1965) 165–227. For an excellent art historical account that stresses the growing separation between art and medicine see Kirchner T., *L'Expression des Passions. Ausdruck als Darstellungsproblem in der Französischen Kunst und Kunsttheorie des 17. und 18. Jahrhundert* (Mainz: 1991), especially 180–207.

ample evidence of medical ideas permeating literature.<sup>2</sup> Barbara Stafford and others have championed the view that a medico-physiological focus left its stamp on eighteenth-century culture by communicating new perceptive horizons of hidden or intangible body processes as well as dreams, semi-conscious states and obscure experience in general.<sup>3</sup>

Among the different developments affecting Enlightenment clinical theory, an invigorated science of physiology is without any doubt the most influential.<sup>4</sup> Once considered a revolutionary break with erudite physiology, the waning of teleological imperatives in present-day histories of science has in no way affected scholarly curiosity in the movement. In fact, attention has been turning to eighteenth-century medico-physiological models as active participants in materialism, the 'radical' philosophy embraced in France by Denis Diderot, Pierre-Louis Moreau de Maupertuis, Julien Offray de La Mettrie, Helvétius and Paul-Henri Thiry, Baron d'Holbach, all of whom became proponents of different elements of contemporary physiological theory.<sup>5</sup> Among these writers, it was above all in the writings of Diderot that materialist inquiries transformed themselves into vehicles for addressing a wide field of interests that stretched from

---

<sup>2</sup> Elementary reading on the history and historiography of eighteenth-century physiology and literature is Rousseau G.S., *Enlightenment Crossings. Pre-and Post-modern Discourses, Anthropological* (Manchester: 1991); Rousseau G.S., *Enlightenment Borders. Pre-and Post-modern Discourses, Medical, Scientific* (Manchester: 1991). See also Roberts M.M. – Porter R. (eds.), *Literature and Medicine during the Eighteenth Century* (London: 1993).

<sup>3</sup> '[...] researches into irritability, or contractibility, and into sensibility or excitability, were part of a greater movement within the history of perception that sent vision inward bound', Stafford B., *Body Criticism. Imagining the Unseen in Enlightenment Art and Medicine* (Cambridge, Mass.: 1991) 409. On Diderot's predisposition to merge the clinical with the fictional see Chouillet J., *Diderot poète de l'énergie* (Paris: 1984), Delon M., *L'idée d'énergie au tournant des lumières* (Paris: 1988) and Vila, *Enlightenment and Pathology* 111–151.

<sup>4</sup> Of particular interest for the French reception of eighteenth-century studies on physiology are Duchesneau F., *La physiologie des Lumières. Empirisme, modèles et theories* (The Hague: 1982); Vila A.C., *Enlightenment and Pathology. Sensibility in the Literature and Medicine of Eighteenth-Century France* (Baltimore-London: 1998); Williams E., *The Physical and the Moral. Anthropology, Physiology, and Philosophical Medicine in France, 1750–1850* (Cambridge: 1994); Rey R., *Naissance et développement du vitalisme en France de la deuxième moitié du 18<sup>e</sup> siècle à la fin du Premier Empire* (Oxford: 2000); Riskin J., *Science in the Age of Sensibility. The Sentimental Empiricists of the French Enlightenment* (Chicago-London: 2002). Contributions on specific authors mentioned here are Duchesneau F., "Diderot et la Physiologie de la Sensibilité", *Dix-huitième siècle* 31: *Mouvement des sciences et esthétiques* (1999) 195–216; Paganini G., "Psychologie et physiologie de l'entendement chez Condillac", *Dix-huitième siècle* 24: *Le matérialisme au siècle des Lumières* (1992) 165–178.

<sup>5</sup> An example of what I am referring to as a teleological history of the life sciences is for instance Magner L.N., *A History of the Life Sciences* (New York: 1979).

morality and politics to the study of history, evolutionary linguistics and cultural life as such.

This chapter examines representations of the body and vitalist medicine as associated concerns in Diderot's writings. The scope of Diderot's attention to the arts, which encompassed contemporary stage, poetry, prose fiction, painting and sculpture, does not need special introduction here. Yet if students of Diderot have pointed to materialism as providing a coherent pattern of concern through his aesthetics, their accounts seldom cover problems of artistic production.<sup>6</sup> Also missing in present accounts is the way that a medico-physiological understanding stimulated Diderot's engagement with the arts by encouraging a special focus on the human figure. The following discussion will start by charting Diderot's idea of medical knowledge as a factor in artistic production and his debt to Montpellier vitalist medicine. The paper then addresses images of suffering as of particular interest for the interface between medicine and aesthetics, and provides a second relevant context for Diderot's view of the human body as an object of representation: the *Académie royale de peinture et de sculpture* (1663–1793). A little-known letter on a marble group by his friend, the academic sculptor Etienne-Maurice Falconet, will conclude these analyses.<sup>7</sup>

### *Art and medicine*

In the 1765 *Essai sur la peinture*, Diderot turned on the basic method for teaching painting and sculpture in the Paris Royal Academy.<sup>8</sup> He warned of the dangers of relying too heavily on the observation of anatomical models and drawing from the inert posing model, and conjured up an alternative art school that would stimulate the observation of bodies in full life. The youthful visitors to this school would engage in constant observation of individuals as they moved and performed daily tasks. They

---

<sup>6</sup> Diderot's criticisms of the visual arts have repeatedly been discussed in the framework of a preoccupation with the integrity of the aesthetic beholder or of the image as object of aesthetic experience. Examples are Fried M., *Absorption and Theatricality. Painting and Beholder in the Age of Diderot* (Berkeley: 1980); Kohle H., *Ut Pictura Poesis non erit. Denis Diderots Kunstbegriff* (Hildesheim: 1989) and Starobinski J., *Diderot dans l'espace des peintres* (Paris: 1991). By contrast, the present account focuses on body images as objects of a critical discourse that predates philosophical aesthetics. The pioneering study of Magnien A., *La nature et l'antique, la chair et le contour. Essai sur la sculpture française du XVIII<sup>e</sup> siècle*. SVEC (Oxford: 2004) was very useful in thinking about this problem.

<sup>7</sup> A brief consideration of the letter is provided in Magnien, *La nature et l'antique* 226.

<sup>8</sup> Diderot Denis, *Salon de 1765*, ed. Bukdahl E.M. et alii (Paris: 1984) 343–350.

were to use different models, noting differences of sex and age, and if possible observing persons in successive stages of their active lives.<sup>9</sup> By their very nature, these exercises were more than simple stepping stones on the way to 'realism'. As Diderot explained, they are concerned with the epistemological nature of the artist's work. The Paris Royal Academy was not just branded as a tedious place to learn to draw the human figure, but stood accused of having become a depository for deceptive images of human beings and for having a corrupting influence on the imagination of life itself. The goal of the method was to allow students to attain a general understanding of the dynamic nature of bodily appearance, where the body's exterior was subject to a diagnostic gaze that apprehended both personal characteristics and life habits on the basis of an examination of human shape.

Diderot's recommendations carry over into the realm of painting and sculpture a sense of the discussions on the nature of human life then animating the field of medicine. If his two scenarios for schools were supplanted by the physicians of Montpellier and Paris, this would leave us with a striking match. With the Paris camp, we encounter a focus on the study of wax models, surgical autopsy of the dead and a stack of labels with technical terminology denoting illnesses. The Montpellier camp was dedicated to what was known as philosophical medicine. It took an interest in the observation of the living being, stressed the integrity of the healthy organism and created a 'philosophical' method for distinguishing between types of humans. Moreover, that Diderot's school should answer so well to the mission of Montpellier should be no reason for surprise.

Diderot's debt to the school of Montpellier is widely acknowledged, and stands affirmed by much of his later writings. His personal acquaintance with Théophile de Bordeu and Jean-Joseph Ménuret, both contributors to a series of influential medical articles for the *Encyclopédie*, turns into a lasting intellectual bond after 1765, with the posthumously published dialogue *Rêve de d'Alembert* (which, written in 1769, features de Bordeu as Mlle. de l'Espinasse's interlocutor) and the *Éléments de physiologie* (intermittently written in 1774–1780), writings that constitute Diderot's crowning achievement as an amateur medical philosopher. The mounting assimilation of ideas from Montpellier physicians – to which were added multiple borrowings from physicians of different orientation, from

---

<sup>9</sup> Diderot, *Salon de 1765* 349.



La Mettrie and Buffon to Haller – coincides with a turning point in his accounts of modern painting and sculpture, the mid-1760s Salons, where Diderot arguably evolves an understanding of the creative powers of the artist as partaking in a medical type of knowledge.<sup>10</sup> As early as the 1758 *De la poésie dramatique* it becomes clear that, for Diderot, medico-physiological discourse amounts to much more than diagnostics: it stands for the elaboration of a model for the observation of individuals, resulting in a socially meaningful ‘science of man’.<sup>11</sup> To Diderot, observation, speculation and taxonomical arrangement are at the forefront of any efforts at producing body images.

Although Diderot occasionally revised his allegiances to contemporary artists, he nevertheless found – and most notably in the Salon of 1765 – two reliable touchstones for this enlarged sense of medical knowledge. The first was David Garrick, the British actor whose stunning performance style incited his highest praise, and the other was the achievements of Greek sculptors.<sup>12</sup> Greek sculptors are said by Diderot to have created an ideal model so true that they could at will ‘deduce’ from it all possible manifestations of human life.<sup>13</sup> In their expert command of the human figure, Garrick and the Greek sculptors both coined art’s highest achievements. The medico-artistic nexus thus created has, first, to result in a firm belief in the intimate relations between the physical and the moral, which was entirely consonant with materialist philosophy. A second, and equally important, point is that Diderot extracts from Garrick and the Greek sculptors, as he had from drawing school, a mechanism of the artistic process, casting image-making as a procedure similar, if not identical, to clinical duties of observation, diagnostic interpretation and the elucidation of the particular in terms of a comprehensive ‘science of man’.

Diderot’s artists of preference cast particularly penetrating gazes on the body. The 1763 fictional elaboration of an account of Falconet’s *Pygmalion group*, exhibited in that year’s Salon, is an example of this. The

<sup>10</sup> Magnien, *La nature et l'antique* 196–218. See also Strugnell A., “Diderot, Hogarth and the ideal model”, *British Journal for Eighteenth Century Studies* 18 (1995) 125–137.

<sup>11</sup> Diderot’s ideas on the study of man are developed in the ‘Ariste’ passages in the final section of *De la poésie dramatique*. Green F. (ed.), *Diderot’s Writings on the Theatre* (New York: 1987) 203–210. Connections between Diderot’s interest in physiology and the late Enlightenment project for ‘l’observation de l’homme’ were explored in Courtine J.J. – Haroche Cl., *Histoire du visage* (Paris: 1988) 142.

<sup>12</sup> Diderot Denis, *Diderot on Art, Vol. II. The Salon of 1767*: ed. Goodman J. (New Haven-London: 1995) 15–16. See also Strugnell “Diderot, Hogarth and the Ideal Model”.

<sup>13</sup> On this process of ‘deduction’ see Green F. (ed.), *Diderot’s Writings on the Theatre* (New York: 1987) 207–210.

mythological tale of Pygmalion told of a statue that becomes animated by a supernatural infusion of the 'breath of life' (allegorised in Falconet's group by the addition of a little putto blowing on Galatea's hand). Diderot admired the sculpture, but then he went on to introduce a fresh approach to it. In using the surgeon's encounters with a patient as the dominant analogy, he devised a new action for the group that would place the putto less prominently and have Pygmalion, the sculptor, perform a more physical act of care. In the revised narrative Pygmalion is turned from a passive onlooker to an active participant, guiding and observing the process of animation that unfolds before his eyes by feeling the statue's pulse and looking into its eyes as he awaits the opening of the eyelids.<sup>14</sup>

Throughout the writings of the French materialists, classicising sculpture would prove to be a natural sounding board for such tales of animation, largely because its life-size single figures had a full-bodied material presence reminiscent of real bodies.<sup>15</sup> In the prelude to Diderot's 1769 *Rêve de d'Alembert* a marble statue is pulverised and left to be consumed by moss, until its components re-enter, through ingestion and fermentation, the configurations of plants, animals and 'conscious' beings.<sup>16</sup> The story, along with much of what follows it, illustrates an important point about the Montpellier physicians' desire to set themselves apart with regard to both animists and mechanists. Organic life should not be accounted for entirely in terms of mechanical forces. Living matter is different, and its mysteries must be broached in terms of a search for the vital principle. Medicine must look for answers in the living (not the dissected) body, and try to grasp its functional integrity. Finally, all manifestations of life (vegetal, animal, 'conscious') share the same basic characteristics, in that in order to have unity and sensibility they all depend on a fortuitous organisation of matter that ensures the reciprocal action of small living body parts.<sup>17</sup>

<sup>14</sup> Seznec J., *Salons de Diderot* (Oxford: 1957–1967), vol. I, 245–246; Bukdahl E.M., *Diderot critique d'art* (Copenhagen: 1980), vol. I, 235–236.

<sup>15</sup> The theme of the live statue in eighteenth-century France is discussed in Carr J.L., "Pygmalion and the Philosophes: The Dream of the Animated Statue in Eighteenth-Century France", *Journal of the Warburg and Courtauld Institutes* 23 (1960) 239–255; Démoris R., "Les statues vivent aussi", *Dix-huitième Siècle* 27 (1995) 129–142; Mainz V. – Williams R., *Sensing Sculpture at the Time of the French Revolution* (Leeds: 2006).

<sup>16</sup> Diderot Denis, *Rêve de d'Alembert*: ed. Vernière P. (Paris: 1951) 1–20.

<sup>17</sup> For my account of Montpellier school vitalism I rely mostly on Williams, *The Physical and the Moral* 20–66 and Wolfe C.T. – Terada M., "The Animal Economy as Object and Program in Montpellier Vitalism", *Science in Context* 21, 4 (2008) 537–579.

*Montpellier and Vitalist medicine*

The medical outlook that pervaded Diderot's various writings was neither wholly divorced from mechanistic models nor conducive to a strongly decentralised conception of the body. Indeed, some historians of science have found his ideas incoherent and pastiche-like (as is the avowed project of the *Éléments de physiologie*).<sup>18</sup> Here it will suffice to point out that whether he adapted the Montpellier teachings or other sources, Diderot committed himself to taking the recent strands of physiology to their materialist conclusion. Materialists became particularly hostile to accounts professing the existence of a life-giving spiritual force as well as doctrines proclaiming man's possession of an immaterial soul. Recognising the relevance for philosophy of current medical developments, the *philosophes* created a world where the Cartesian hierarchies no longer held, spelling the end of the two-substance subject composed of an immaterial soul commanding a mechanical body.<sup>19</sup> Its place was occupied by a host of new models of life – animist, mechanist, vitalist. The materialists took after the two latter models: man was to them a vital and sensitive physio-psychological subject, a de-centered, self-regulating system of organs where sense-perception and consciousness appeared so inextricably tied together that embodied sensibility emerged as the only acceptable life-principle.

Among the dominant clinical denominations active in mid-century – Stahlian animists, Cartesian medicine, Newtonian physiology, iatromechanists – most representatives of the school of Montpellier adhered to a 'vitalist' or 'material vitalist' creed, named after its basic premise, the Aristotelian postulate of a vital force in organic life. Bordeu in addition occupied a position that was uncompromisingly materialist in its denial of extracorporeal agency, of immaterial life forces that Stahlian animists deemed necessary in order to ignite and regulate the pulleys, engines and pumps of a mechanically conceived body. As was remarked by Wolfe and Terada, if Montpellier vitalism countered attempts to reduce the body to

<sup>18</sup> See Bremmer G., "Les *Éléments de physiologie* et le sens de la vie", in France P. – Strugnell A. (eds.), *Diderot. Les dernières années* (Edinburgh: 1985) 81–91.

<sup>19</sup> On the tensions between the Cartesian dual subject and an embodied modern aesthetics see the general introduction in Jones A., "Body", in Nelson R.S. (ed.), *Critical Terms for Art History* (Chicago-London: 2002<sup>2</sup>) 251–265. Barbara Stafford has argued in favour of understanding modern embodied aesthetics and enlightenment medicine in relationship to one another. See Stafford, *Body Criticism*.

a mere machine, it nevertheless used mechanism to impart a sense of the way in which the body arrives at its vital force.<sup>20</sup>

Nothing outside the body, Bourdeu said, causes life. Instead, the life principle depends on the particular, harmonious organisation of small body parts, which engender a functional unity because their independent actions answer to one another in ways that enhanced organic unity. In his model 'vital properties are accounted for in terms of the interaction between anatomical structure (the cause) and physiological function (the effect)'.<sup>21</sup> Life was a 'necessary attribute' of the specific combinations and interconnections between fibres, vessels, glands and organs. Admitting the difficulty of explaining his notions of 'animal oeconomy' and 'organisation' by recourse to a consistent technical vocabulary, Bordeu used images that proved extremely popular. His best known metaphor is the swarm of bees ('grappe d'abeilles'), to which Ménuret added the poetic figure of the 'flock of cranes which fly together, in a particular order, without mutually assisting or depending on one another'. More daringly, the vitalists played with analogies of lifeless constructions, as in Ménuret's account of the laws of acoustics and resonance that set musical strings to vibrate as if by themselves.<sup>22</sup> As these analogies were to show, the state of 'sympathy' that prevailed in the healthy body consisted of a 'connection of actions' between conjoining and consecutive movements of smaller body structures.

In the *Rêve de d'Alembert* vitalism fuelled an outlook on subjectivity that passed from embryology to physiology and psychology. Diderot's human being existed in a tension between an endless sensory articulation (the fibres or 'brins') and a nervous centre. The 'origine du faisceau', as this centre was called, produced judgment, imagination and all functions of consciousness by grace of its capacity to store sense-impressions as memories. In his *Rêve*, Diderot, using Bordeu as his mouthpiece, explained consciousness as that animal state in which the nervous centre and the organs of sensory perception lodged in the body's extremities were engaged in a harmonious mode of collaboration. When this was not the case, all

<sup>20</sup> Wolfe – Terada, "The Animal Economy" 536.

<sup>21</sup> Wolfe – Terada, "The Animal Economy" 557.

<sup>22</sup> Wolfe – Terada, "The Animal Economy" 551–552 and 565–568. Wolfe and Terada argue that a materialist outlook is inherent in the vitalist concept of an 'animal oeconomy'. They counter traditional views stressing the notion of a delocalised sensibility and register the presence of mechanism as part of the 'scientific program' in the school of Montpellier.

kinds of pathological effects took possession of the subject. Particularly interesting is Diderot's belief that all great men (sages, 'philosophes') possess centres that act by minimising unwanted sensory information, giving them a capacity for determination and for influencing others.<sup>23</sup>

The passage from Cartesianism to vitalism (and the intricate transformation of the machine analogy in physiology from model to explanatory principle) will be shown to be the best way of broaching the change that takes effect with Diderot's accounts of material images of life. To fully appreciate this change, we can now turn to the Paris Royal Academy, where a form of critical interest emerged in how life was to be expressed in representations of human figures. By a detailed reading of descriptions of a sculptured figure, it will be shown that a medical Cartesianism was a factor in the interpretation of artworks.

#### *A seventeenth-century diagnosis of the Laocoön*

*Laocoön* is a subject from the *Aeneid*, well known from a Hellenistic marble group representing the story of the death of the Trojan High Priest as divinely inflicted revenge for his premonition of the fall of Troy. The group, discovered in 1506 and almost immediately transformed into a standard of classical art, arranges Laocoön naked with his two sons on either side, in the stranglehold of giant sea snakes [Fig. 1]. Casts after the principal figure in the group were the origin of a series of elaborate descriptions that came from the theoretical debates of the artists' Royal Academy in Paris between 1666 and 1676. They anticipated Diderot's discussions of suffering bodies, serving as reminders that the novelty of Diderot's aesthetic program resided not in his idea of introducing clinical terms in his critical vocabulary, but rather in freeing the inherited vocabulary from a Cartesian dualist understanding of the body.<sup>24</sup> The imagery of mortal

<sup>23</sup> Diderot, *Rêve de d'Alembert* 126–130.

<sup>24</sup> Although I build upon several contributions on the *Laocoön* both in the context of French seventeenth-century art theory and eighteenth-century German aesthetics, my main aim here is to reveal the perceptive discontinuities that appeared as a result of changing medico-physiological diagnostic interpretations. Helsdingen H.W. van, "Laocoön in the Seventeenth Century", *Simiolus* 10, 2/3 (1978–1979) 127–141; Décultot E., "Les Laocoön de Winckelmann", in Décultot E. – Rider J. le (eds.), *Revue Germanique Internationale* 19: Le Laocoön: histoire et réception (2003) 145–157 and Michel C., "Anatomie d' un chef d'oeuvre: Laocoön en France au XVII<sup>e</sup> siècle", in *ibidem* 105–117.



Fig. 1. *Laocoön*, copied from the original (ca. 200 BC) by the three Rhodian sculptors Agesander, Athenodorus and Polydorus. Marble, height 184 cm. Rome, Vatican, Museo Pio-Clementino.



suffering had a long legacy in early modern art. It is often supposed that the opprobrium of classicist decorum had been responsible for inhibitions towards images of fierce violence in the arts. Yet it would appear that seventeenth-century viewers (accustomed to pray before images of martyrdom) seemed less affected by them than sections of the public in the eighteenth century. And even then the production of very graphic displays of suffering found not just opponents (Lessing), but also lukewarm proponents (Winckelmann) as well as outright enthusiasts (Diderot). A formalist aesthetics such as the one developed by Lessing, incidentally, was intimately involved in condemning the visual spectacle of suffering as ugly, offensive and unfit for all manner of visual representation.

Although confronted with a carving consisting of a three-figure group, the artists of the Royal Academy set out with diagnostic interpretations to convey both the ordeal of the body and the state of the soul. This is clear as early as the 1668 Félibien edition of academic 'conférences'. One lecturer, the sculptor Gérard van Opstal, argued that artists should go as far as possible in their study of the *Laocoön*, both in order to acquire a medical understanding of the causes of the symptoms visible on the body's surface, and to learn how to represent the effects of violent movement in a dignified way:

[...] all of these strong expressions cannot be learned simply by copying the model, because one could not put the model in a state where all passions occur in him. Furthermore, it is difficult to copy them directly from persons in whom these passions actually occur, because of the speed of the movements of the soul. It is thus very important for artists to study their causes, and in order to see to what extent one can represent their effects with dignity, one can say that it is to these beautiful antiques that it is necessary to have recourse, since one finds expressions which one would have difficulty in drawing from life.<sup>25</sup>

---

<sup>25</sup> "Et même, comme toutes ces fortes expressions ne se peuvent apprendre en dessinant simplement d'après le modèle, parce qu'on ne saurait le mettre en un état où toutes les passions agissent en lui, et aussi qu'il est difficile de les copier sur les personnes même en qui elles agiraient effectivement à cause de la vitesse des mouvements de l'âme. Il est donc très important aux ouvriers d'en étudier les causes, et pour voir combien dignement on en peut représenter les effets, on peut dire que c'est à ces belles antiques qu'il faut avoir recours, puisque l'on trouve des expressions qu' on aurait peine à dessiner sur le naturel." Lichtenstein J. – Michel C. (eds.), *Conférences de l'Académie royale de Peinture et de Sculpture* (Paris: 2006), vol. 1, 130–131.



In the Félibien edition, Van Opstal's lecture was complemented by a discussion in which Charles le Brun is likely to have played an important role.<sup>26</sup> Le Brun became known for his singular theory of facial and corporeal expression and the accompanying graphic series depicting the passions, a project on which he worked for years and which was directly inspired by Descartes' 1649 *Les Passions de l'âme*.<sup>27</sup> Moreover, it is of particular interest that le Brun and van Opstal both declined to deal with the group as such, and instead focused solely on the central figure, the High Priest. In the segment of van Opstal's lecture presumably by le Brun, this one figure was discussed for two sets of bodily features, one pertaining to the father's high birth, the other to the effect of the terrible circumstances affecting both him and his sons. Whereas van Opstal had associated the *Laocoön's* passions with their causes, and registered their effects on the body as determined by *Laocoön's* dignified appearance, le Brun firmly ascribed the stable and the short-lived qualities to two mutually exclusive sets of bodily signs, the first able to be interpreted by reference to physiognomy, the second by le Brun's own evolving Cartesian theory of pathonomics:

It was also acknowledged that what made this figure particularly commendable is the deep knowledge which the artist has deployed in showing all of the markers that revealed the high birth of the figure being represented, as well as the true state the figure found himself in when devoured by these snakes which, coming out of the depths of the sea, threw themselves on him and on his two children.<sup>28</sup>

The problem facing both le Brun and the others who continued van Opstal's reflections on the *Laocoön* was to establish a plausible tool for distinguishing bodily features of dignity (which in le Brun's interpretative model were osseous and muscular) and those that illustrated mortal danger and depended on a continuum between the soul's passions and cor-

---

<sup>26</sup> Van Opstal made the delivery of his lecture on July 2, 1667. Along with other texts of the Félibien edition, it was frequently read anew in the eighteenth century, for instance on March 5, 1735. For a discussion of it see Helsdingen van, "Laocoön", Michel, "Anatomie" and Lichtenstein – Michel, *Conférences* 1, 127–136.

<sup>27</sup> See on le Brun's investigations on the expression of the passions and its derivations from Descartes Montagu E., *The Expression of the Passions* (London: 1994) and Desjardins L., *Le Corps parlant. Savoirs et représentation des passions au XVII<sup>e</sup> siècle* (Quebec: 2000).

<sup>28</sup> "On reconnut encore que ce qui a rendu si recommandable cette figure, c'est la profonde science que l'ouvrier a fait paraître à bien représenter toutes les marques qui peuvent faire connaître la haute naissance de celui dont il a voulu faire l'image; et le véritable état où il se trouva lorsqu'il fut dévoré par ces serpents qui, sortant du sein de la mer, se jetèrent sur lui et sur ses deux enfants." Lichtenstein – Michel, *Conférences* 1, 131.

poreal afflictions. How could one pass from an identification of high birth to the display of the condition of turmoil without the body's apparent physiological functions and its physiognomic structures cancelling each other out? Such an interpretative tool was in practice difficult to identify, and le Brun camouflaged its absence by a blind confidence that the unity of exterior effects (a unity that existed only when the beholder was drawn into an intellectual interpretation of clinical signs caused by physiological flux) somehow corresponded with a compositional unity that made the *Laocoön* visually satisfying as a image. He diagnosed the figure's visible marks of tribulation as straightforward documents of what would happen in real life, and then he asserted that, once the sculptors had complied with these medical requirements, they would devise a human figure universally adequate for their expressive purposes, so that every last element would confirm the same state of agitation:

[...] there is not a single feature in all this body where one does not recognise the confusion and agitation felt by a man in a similar state.<sup>29</sup>

There was a spectacular element to le Brun's diagnostic of the *Laocoön*, which was confirmed by his insistence on the idea that the figure's animate condition was manifested over the entire body surface. But, turning now from the formal problems of diagnosis to those of underlying medical beliefs, we should ask whether le Brun's satisfaction at the image of suffering in the *Laocoön* is consonant with a Cartesian dual understanding of the body. One indication that this would have been the case comes from le Brun's references to the classically Galenist notion of 'esprits' (pneuma), which he understood in the way that Descartes proposed in the latter's *Les Passions de l'âme*. Descartes believed that 'esprits' travelled in the blood, entering the nervous system through a valve in the pineal gland in direct articulation of the soul's response to the stimuli received from the body. By relying on the theory of 'esprits' le Brun reinforced the mechanistic underpinnings to his assumption that all the exterior movement in the body of *Laocoön* constituted a unity. The unity in his account came from the fact that all of these afflictions were said to have a single source: a state of the soul, as it succumbed to the terror inspired by the sight of the snake and the conscious realisation of fatal danger. The rest was mechanist physiology: the 'esprits' transmitted the soul's message in the nervous

<sup>29</sup> Lichtenstein – Michel, *Conférences* 1, 134 '[...] il n'y a pas une seule partie dans tout ce corps où l'on ne reconnaisse la trouble et l'agitation qu'a pu ressentir un homme qui s'est trouvé dans un pareil état'.

system to the muscles and caused the general trembling and movement that affected Laocoön's body.

An encompassing physiological activity recurred in other seventeenth-century interpretations of the classical group. Pierre Monnier, in his 1676 contribution *Sur les muscles du Laocoön*, used the image of air leaving the pipes of an organ to illustrate the perfect correspondence of muscular action with signals from the brain.<sup>30</sup> Michel Anguier's 'conférence' on the *Laocoön* from August 2, 1670 was by far the most complex attempt to account for the unity of the image's exterior effects by its reference to a mechanically-coherent bodily articulation of a soul in thrall to terror. Anguier subscribed to the seventeenth-century mechanistic commonplace of regarding the nervous system's 'esprits' as engines of the muscles, using the analogy of a drifting herd of sheep as a further metaphor for the *Laocoön*'s 'tremblement et palpitation universels des muscles'.<sup>31</sup>

Anguier made a detailed account of how the causes for all of the effects that the *Laocoön* was undergoing came down to just one: a single state of appalling horror. He divided these effects into three different categories: the simple perception by the terrified soul of the snake's attack, the physical reaction to the snake's poisoned bite and subsequently the counter-action (now psychological as well as muscular) of Laocoön's attempt to escape. Within the parameters of this elaboration, which showed that van Opstal and le Brun had gone about analysing the *Laocoön* in too simple a manner, his medical model was consonant with le Brun's. Mechanism is intact in his analysis of the 'overall movement' into aggregate causal registers at different stages of development. Cartesianism left an imprint in these descriptions in the same way that it permeated le Brun's descriptive and graphic series of facial and corporeal expression. The soul's impermeability to mechanisms of physiology ensured that messages sent by animate states are the same, no matter what the body. Anger, fear, joy articulated a universal language of expression. Such assumptions were to be severely tested by the intervention of vitalist medicine.

<sup>30</sup> Monier P., "Sur les muscles du Laocoön", in Lichtenstein – Michel, *Conférences* 1, 581–593. For a discussion of Monier's lecture see Michel, "Anatomie".

<sup>31</sup> Like le Brun, Anguier is intent on explaining the causes of the 'tremblement et palpitation universels des muscles' in the body of Laocoön. This dispersed motion is due to the action of 'esprits' conducted through the nerve system from a single source, the brain. A manuscript based on Anguier's text was annotated by Caylus in the 1750s, and his contemporary Falconet is likely to have known it. Anguier M., "Le Groupe de Laocoön", in Lichtenstein – Michel, *Conférences* 1, 383. For a discussion of Anguier's *conférence* see Michel, "Anatomie".

*'Different patients'*

A later example of criticism of sculpture that incorporates a diagnostic gaze is Diderot's 1774 letter on Etienne-Maurice Falconet's carving *Milo of Croton*. For a proper understanding of its significance, it is important to address the context in which Diderot wrote his *Milo* letter. In the spring of 1774, Diderot had taken up temporary residence in The Hague, where he was been cordially admitted as a guest by the Leiden University philosopher Frans Hemsterhuis, himself an avid reader of modern medicine and writer in 1769 of a *Lettre sur la sculpture*. One day, while Hemsterhuis was away on a visit, Diderot wandered into his cabinet, and his eyes fell on a plaster he immediately recognised: it was a model after Falconet's marble *Milo* [Fig. 2].<sup>32</sup> Not only is the letter contemporary with work on the *Éléments de Physiologie*, but in addition in the preceding year Diderot had concluded an argument with Falconet on his *Observations sur la statue de Marc-Aurèle* (1771), using some of Bordeu's teachings as ammunition against Falconet's dismissal of the horse in the celebrated bronze equestrian statue of Marcus Aurelius in Rome. Notably, in his letters to Falconet Diderot had recovered the vitalist project to put medicine to social use by adopting a typological outlook on humanity. Diderot encouraged Falconet to be attentive to the way the shape of animals and human beings emerge as a result of their personal 'histories', each unique for the variety of daily labours and functions they performed.<sup>33</sup> Of course Diderot, who is described in Schenker's recent biography as 'the greatest admirer of Falconet's art and his closest intellectual friend in Paris', had had ample opportunity to look at the original marble and ask the artist questions about it.<sup>34</sup> But this friendship had soured; as Diderot looked at the *Milo*, he was unable to delight in the horror, and instead became profoundly troubled by it.

Diderot sent his evaluation of the *Milo* in a letter to his friend Dimitry Alekseevich Golitsyn.<sup>35</sup> To Golitsyn Diderot proclaimed the need to take a long, fresh look at the *Laocoön* as an image of 'man afflicted' ('un homme

<sup>32</sup> The presence of a replica of the *Milo* in the Low Countries can be ascertained by its inclusion in a drawing of the Andriessen family house in Amsterdam in the 1800s.

<sup>33</sup> Dieckman H. – Seznec J., "The Horse of Marcus Aurelius: A Controversy between Diderot and Falconet", *Journal of the Warburg and Courtauld Institutes* 15 (1951): 198–228.

<sup>34</sup> The fragment is from Schenker A.M., *The Bronze Horseman. Falconet's Monument to Peter the Great* (New Haven-London: 2004) 20.

<sup>35</sup> 'Au prince Dimitri Galitsine' signed "La Haye, 10 mai 1774", in Diderot Denis, *Œuvres*, vol. 5, Correspondance (Paris: 1998) 1233–1236.



Fig. 2. Etienne Maurice Falconet, *Milo of Croton*. 1754. Marble, height 66 cm, width 64 cm. Paris, Louvre.

qui souffre'), adding, in a revealing slip-of-the-tongue, that *Milo* and *Laocoön* constitute nevertheless two 'different patients'. Falconet had portrayed the story of a legendary athlete who was devoured by a lion after his hand got caught in the cleft of a tree bark. The carving was presented in 1754 as the sculptor's presentation piece ('morceau de reception'), the last prerequisite for full membership of the Royal Academy. Diderot narrowed down his discussion by focusing on the figure of *Milo*, ignoring the lion and natural embellishments of the group just as le Brun and his followers had ignored Laocoön's sons. Setting up his diagnostic activity in this way, Diderot's letter claimed that *Milo* was a subject of great interest that Falconet had spoiled by a bad performance, for the actor had been miscast and his action misjudged. 'If the fighter from Croton is not a distinguished citizen, he is even less a crook'.<sup>36</sup> As his many euphemisms for Falconet's figure – 'villain', 'crook', 'cunning devil' – made clear, in looking at the tormented *Milo* Diderot was uncomfortably reminded of a seedy underworld. An artist may reasonably have been expected to have made the struggles of the legendary athlete less easy to mistake for those of a criminal condemned to the wheel. These remarks were already pregnant with associations taken from the school of Montpellier, in that a soul whose states found identical expression in all humans (the Cartesian warrant for le Brun's theories of expression and of his account of the *Laocoön*) had been displaced by a moral condition that construed itself in terms of physical condition – in the case of *Milo*, a condition of bravery and muscular strength.

Diderot affected a diagnostic gaze to correct two movements and a general condition visible in Falconet's *Milo*: the expression of the figure's scream, the 'necessary sympathy between muscles', and the inflection in *Milo*'s consciousness of a 'system of the suffering animal'. The first was couched in a mechanical account of the action of the torso as a result of violent inhaling or exhaling, whereas the sympathy derived from ideas specific to Ménuret and Bordeu, who defined 'sympathie' as a general correspondence between body parts in their agitation. Finally, Diderot's understanding of the 'system of the suffering animal' led him to resolve his criticisms in a way that was consistent with his materialism: there was a profound conceptual error in collapsing two different human types, as if singular events transformed subjects with different histories in the same

---

<sup>36</sup> 'Si le lutteur crotoniate n'est pas un citoyen distingué, c'est encore moins un cartouchien', Diderot, *Œuvres*, vol. 5, 1234.



manner. Yet it was out of an awareness that the *Laocoön* and *Milo* were indeed 'different patients' that the diagnostic gaze had to become committed in a metaphysical sense. Questions about mind and body could not be avoided.

The effects of the scream were visible in Falconet's marble on the lower half of the upper body, extending between the pubis ('os pubis') and the lower stomach ('creux de l'estomac'). Here, Diderot was dismayed by a blurry sequence of folds and cavities. He remarked:

Imagine that in this position the intestines fall towards this lower part where the bigger of the two hollows has been made, both of which I find shocking. A hollow would be acceptable in the upper part. But these two cavities are both false. A man who screams, exhales violently, causing the area of the stomach and the lower abdomen to subside and extend in equal proportion.<sup>37</sup>

As one of a list of anatomical errors, the cavities in *Milo's* stomach betrayed Falconet's feeble grasp of the effects of heavily exhaling. It is significant that the only subcutaneous speculations Diderot ventured into when looking at the *Milo* concern breathing and the push and pull of muscles and intestines – there was no mention of the circulation of blood or the flow of spirits, as there had been in le Brun and Anguier. It would appear that le Brun had been looking back to the Galenist a-mechanical heart, which expands and contracts obeying the soul's changing states. Certainly, it was in terms of an aggressive flux of the 'esprits' that the seventeenth-century 'conférenciers' had liked to explain the exhalation of the *Laocoön*. René Bary, writer of a 1702 handbook on oratory techniques that contains an essay on 'le geste de l'horrible' evinced this particular diagnostic method:

The horrible requires that one opens the eyes and the mouth extraordinarily, that one turns the body away towards the left a little, and that both hands are outstretched as if in self-defense, because those who are about to suffer the ultimate cruelty, frantically look for every possible means of avoiding death; that the fear choking the heart by the withdrawal of the spirits prompts the mouth to open wide; and that the same fear which tight-

---

<sup>37</sup> 'Songez que dans cette position les intestins tombent vers cette partie inférieure où l'on a pratiqué le plus considérable des deux creux qui me choquent. Un enfortement serait tout au plus supportable à la partie supérieure. Mais ces deux cavités sont fausses l'une et l'autre. L'homme qui crie, pousse son halaine violemment en dehors, action qui affaïse et étend en même proportion la région du ventre et du bas-ventre'. Diderot, *Œuvres*, vol. 5, 1234.



ens the heart also dilates the mouth, turns the body away, and stretches out the hands.<sup>38</sup>

Bary, who instructed orators, traced the afflicted body's many motions to a single idea. This was fear, which inhabits the soul and dispatches its messengers, the animal spirits, to the different organs, while functioning as the foil for an aesthetic experience of moving body parts and surfaces unified by a single principle of motion. All that was left of this as Diderot beheld the *Milo* was a violent exhaling with no specific, central cause, but rather with a finality – to scream. By the second half of the eighteenth century Bordeu had discredited the Galenist thesis of 'esprits animaux'.<sup>39</sup>

What concerned Diderot most about *Milo's* breathing was what it signified as psychological marker. How did the victim see and understand his situation? Diderot was distressed that Falconet's *Milo* should appear so lamely downtrodden:

This *Milo* has the countenance of a man whose every member is in irons, so defenseless is he. Prometheus shackled in the Caucasus would not behave otherwise under the beak and the claws of the bird that cuts him up.<sup>40</sup>

Leaving the 'safe' zone of anatomical discernment meant that the critic could only demonstrate the falsity of the action by empathically imagining what the athlete would *really* have done. The character of *Milo* now posed a serious challenge to his recumbent position and the ineffectual movement of the limbs, none of which are engaged in confronting the lion:

A man like this terrible *Milo* should not allow himself to be devoured like a fool. In the situation that he has been put into, in the imminent danger that visits him, what should he do? (He must) avail himself of his right arm,

---

<sup>38</sup> 'L'horrible veut qu'on ouvre extraordinairement les yeux et la bouche, qu'on détourne un peu le corps vers la côté gauche, et que les deux mains étendues servent comme de défense, parce que ceux qui sont sur le point de souffrir les dernières cruauté, cherchent par-tout de l'oeil les moyens d'éviter la mort; que l'effroi étouffant le coeur par la retraite des esprits porte la bouche à donner à l'air un grand passage; et que le même effroi qui serre le coeur, dilate la bouche, détourne le corps, et étend les mains'. Bary René, *Méthode pour bien prononcer un Discours, et pour le bien animer* (Leiden: 1702) 87–88. A similar description is given by Jelgerhuis in his 1827 treatise on acting: 'Concerning the whole figure, one must establish that during terror the hands are stretched out, or rather opened up, and especially the fingers are to be set apart, also the setting apart of the legs must be observed'. Cited after Barnett D., *The Art of Gesture. The Practices and Principles of Eighteenth-century Acting* (Heidelberg: 1987) 49.

<sup>39</sup> For the first time in his 1743 thesis *Recherches sur les crises*.

<sup>40</sup> 'Ce Milon a l'air d'un homme garrotté de tous ses membres, tant il se secourt peu. Un Prométhée enchaîné sur le Caucase ne serait pas autrement sous le bec et les serres de l'oiseau qui le dépèce'. Diderot, *Oeuvres*, vol. 5, 1235.

caught in the slit of the tree, using it as a point of support for the remainder of his body; then release his left arm from underneath him, where it is useless as a support, and with the left hand seize the animal's upper jaw, crushing it and forcing out the eyes of its head, as should be the capacity of a man of this size who resolves to separate a tree.<sup>41</sup>

*Milo's* heroic struggle was also a type of suffering, and this aspect too should dictate the entire figure. Hence, even though one was dealing with different patients, Diderot would have Falconet re-examine the *Laocoön*; that is, look at it with greater discernment in terms of its competences, and thus discover that action in a figure depends less on the objective situation than on a subject's consciousness of his own powers, his basic stance in the face of events:

The *Laocoön*, whose feet the artist borrowed for his *Milo*, should have taught him that one can suffer with dignity. Snakes tearing apart a father in full sight of his children, one of whom is expiring and the other will soon undergo the same fate, are well worth a lion. I know that a high priest is not an athlete. But the latter has his own nobility and confidence; nothing so enhances this as an awareness of the body's strength, if not the elevation of the soul; and whatever differences may exist between the conditions of two patients, there is a happy medium in everything.<sup>42</sup>

By 1774, Diderot had seen how Winckelmann, Lessing and his host in the Hague, Hemsterhuis, had taken issue with the production of images in painting and sculpture that portrayed violent circumstances, shifting the parameters with which the paramount representative of this subject matter in antique sculpture, the *Laocoön*, was being valued.<sup>43</sup> Diderot, for

---

<sup>41</sup> 'Un homme comme ce terrible Milon ne doit pas se laisser manger comme un sot. Dans la position où on l'a mis et dans le péril imminent où il se trouve, que doit-il faire? Se servir de son bras droit pris dans la fente de l'arbre, comme d'un point d'appui pour tout le reste de son corps; dégager son bras gauche de dessous lui où il est inutile pour le soutenir; et saisir de la main de ce bras l'animal par la mâchoire supérieure, la lui écraser et lui faire sortir le yeux de la tête, comme un homme qui s'est promis de séparer un arbre de la grosseur de celui que je vois, devait en être capable'. Diderot, *Œuvres*, vol. 5, 1234.

<sup>42</sup> 'Le *Laocoön* dont l'artiste a emprunté les pieds de son *Milon* aurait bien dû lui apprendre qu'on peut souffrir avec dignité. Des serpents qui déchirent un père à la vue de ses enfants, dont l'un est expirant et l'autre subira bientôt le même sort, valent bien un lion. Je sais qu'un grand prêtre n'est pas un athlète. Mais celui-ci a sa noblesse et sa sûreté; rien n'en donne plus que la conscience de la force du corps, si ce n'est de l'élévation de l'âme; et quelque différence qu'il ait entre les conditions de deux patients, il y a une juste mesure à tout'. Diderot, *Œuvres*, vol. 5, 1233.

<sup>43</sup> See Rees J., "Der Apoll vom Belvedere und die Laokoon-Gruppe im Spektrum von Kunsttheorie und Antikrezeption im 18. Jahrhundert", in Mai E. – Wettengl K. (eds.), *Wettstreit der Künste. Malerei und Skulptur von Dürer bis Daumier* (Munich: 2002) 153–169. On Hemsterhuis' evolving attitude towards the passions, perception and the *Laocoön* see

his part, had ceased demanding an aesthetic unity in the *Milo* unless it was warranted by physiological truth. His use of the 'sympathie' did not comprise a general recurrence of events on the body surface. This is evident in his remark that *Milo's* fingers and toes, some of which are relaxed and others contracted, did not give the impression of belonging to the same 'système d'animal souffrant'. On a clinical register, Diderot's materialism asserted itself in the absence of a semiotics of the soul, and the implicit assumption that none of the unity of the suffering subject transcended its animal sensibility or its anthropological psychology.

Diderot's materialism, in the event, spelled trouble for the coherence of aesthetic experience, or at least for his reflections on the artistic process. Depending on its degree of movement, corporeal inertia or vitality gave rise to different types of pictorial composition, causing the dynamic of absorption and theatricality described by Michael Fried.<sup>44</sup> There are detailed descriptions of sufferers in the *Salons* of the 1760s that exemplify this rift. Take, for example, the figures afflicted by the illness then known as 'St. Anthony's fire' in Diderot's description of Doyen's painting of *The Miracle of St. Anthony's Fire*, which was exhibited in the Salon of 1767. Doyen did not spare his viewers any amount of gruesome detail: in a desolate cityscape scattered with cadavers he mounted body upon body of men succumbing to seizures and convulsions.<sup>45</sup> After meticulously describing these abject scenes (fifteen pages in the recent English edition), Diderot turned to the painter in gratitude:

Where am I to expect scenes of horror, frightening images, if not in a battle, a famine, a plague, an epidemic? If you had asked the advice of these people with delicate, refined taste afraid of sensations that are too strong, you'd have painted over your frenzied man throwing himself from the hospital, and the stricken man tearing at his side at the floor of your platform: and I'd have set fire to the remainder of your composition [...].<sup>46</sup>

Diderot's description of Doyen's painting was sustained by delight in horror, but a gap had appeared between the discourse of making and that of aesthetic experience. Diderot switched from a detached understanding of the individual bodies to an openly epicurean delight at the harrowing image of plague. Although he attempted to reconnect the two through a

---

Sonderen P.C., *Het sculpturale denken. De esthetica van Frans Hemsterhuis* (Leende: 2000) 154–203.

<sup>44</sup> Fried, *Absorption and Theatricality*.

<sup>45</sup> Diderot, *Writings on Art. Salon of 1767* 142–157.

<sup>46</sup> Diderot, *Writings on Art. Salon of 1767* 150.

consideration of paint, chiaroscuro and the compositional whole, physiology no longer had any role to play in this negotiation.

### *Coda*

Considering the many instances of an affinity between thinking about representation and thinking medically, it is time to return to our original question: with regard to Diderot, what was the status of the human figure? The answer is unlikely to lie in our sense of materialism as a creed that simply limits the human to the corporeal. It seems more likely that the exercise of transferring specific accounts of human life from medicine to the arts would help to cement a more comprehensive materialist worldview. First, this act of transfer allowed materialism to take firmer possession of medical traditions sympathetic to its cause, and thus to move vitalist medicine into materialist 'philosophy'. Diderot distilled an amateur theoretical medicine out of a vitalist body of writings that (in particular with Bordeu and Ménuret) already constructed itself as a 'philosophical' medicine in contradiction to specific medical traditions, rejecting both animism and Cartesian dualism. Secondly, in Diderot the medico-physiological turn offers a promise (albeit seldom one that is fully realised) of operating as a corrective mechanism for artistic production.

It should be noted again that, although fine arts had long enjoyed critical discourses of their own, during Diderot's lifetime these discourses were slowly giving way to a formalist aesthetics with writers like Hemsterhuis and Lessing. It would however be misleading to present Diderot's encounter with physiology, even when it occurs in his discussion of painting and sculpture, as a token of the systematic method of philosophical theories on the nature of beauty. If anything, such moments in Diderot's writings challenge the 'spirit of systems'. Aesthetics was no match for materialism as the unifying topology for Diderot's concern for the arts. Nor was he unique in this: in France the system of fine arts only had a handful of relatively isolated supporters, with Batteux' 1746 *Les Beaux-arts réduits à un même principe* being the best example.<sup>47</sup>

A final, but equally important, way in which Diderot's advocacy of a medico-physiological understanding resisted the program of eighteenth-

---

<sup>47</sup> For the rise of philosophical aesthetics in France see Becq A., *Genèse de l'esthétique française moderne (1680–1814)* (Paris: 1984).

century formal aesthetics was that the former's focus was constituted by the human figure (and its embodied audience) rather than the artwork conceived as formal artifact. It follows from this that the nature of Diderot's responses to representations of the human body, linking a physiological reflection on the embodied subject to a critical discourse on 'good' and 'bad' art, had only a passing need of formalist aesthetic thinking (with its systematic and synchronic view of the mutual relations between the arts), while constantly outlining ways for sanitising the arts *as process*, relieving them from their general state of insensitivity, their numbing withdrawal from physical experience. In Diderot, under the conjunction of medical and artistic knowledge lies a tacit program of aesthetic discovery (as opposed to one of permanence), where renewed experience brought deeper connections between art and nature to light and where the repercussions of a materialist view of moral life and subjectivity for cultural production were considered, even when this was done without clear direction or purpose.

*Selective bibliography*

- ANGUIER M., "Le Groupe de Laocoön", in Lichtenstein J. – Michel C. (eds.), *Conférences de l'Académie royale de Peinture et de Sculpture* (Paris: 2006), vol. 1, 377–387.
- BARNETT D., *The Art of Gesture. The Practices and Principles of Eighteenth-century Acting* (Heidelberg: 1987).
- BARY RENÉ, *Méthode pour bien prononcer un Discours, et pour le bien animer* (Leiden: 1702).
- BECQ A., *Genèse de l'esthétique française moderne (1680–1814)* (Paris: 1984).
- BREMMER G., "Les *Éléments de physiologie* et le sens de la vie", in P. France – A. Strugnell (eds.) *Diderot. Les dernières années* (Edinburgh: 1985).
- BUKDAHL E.M., *Diderot critique d'art* (Copenhagen: 1980).
- CARR J.L., "Pygmalion and the Philosophes: The Dream of the Animated Statue in Eighteenth-Century France", *Journal of the Warburg and Courtauld Institutes* 23 (1960) 239–255.
- CHOUILLET J., *Diderot poète de l'énergie* (Paris: 1984).
- COURTINE J.-J. – HAROCHE C., *Histoire du visage XVI<sup>e</sup>–début XIX<sup>e</sup> siècle. Exprimer et taire ses émotions* (Paris: 1988).
- COYPEL A., *Discours prononcés dans les conférences de l'Académie royale de Peinture et de Sculpture* (Paris: 1721).
- DÉCULTOT E., "Les Laocoön de Winckelmann", in Décultot E. – Rider, J. le (eds.), *Revue Germanique Internationale* 19: *Le Laocoön. Histoire et réception* (2003) 145–157.
- DELON M., *L'idée d'énergie au tournant des lumières* (Paris: 1988).
- DÉMORIS R., "Les statues vivent aussi", *Dix-huitième Siècle* 27 (1995) 129–142.
- DESJARDINS L., *Le Corps parlant. Savoirs et représentation des passions au XVII<sup>e</sup> siècle* (Quebec: 2000).
- DIDEROT DENIS, *Diderot on Art, Vol. II. The Salon of 1767*: ed. Goodman J. (New Haven-London: 1995).
- , *Œuvres*: (Paris: 1998), vol. 5, Correspondance.
- , *Rêve de d'Alembert*: ed. Vernière P. (Paris: 1951).
- , *Salon de 1765*: eds. Bukdahl E.-M. et alii (Paris: 1984).
- DIECKMAN H. – SEZNEC J., "The Horse of Marcus Aurelius: A Controversy between Diderot and Falconet", *Journal of the Warburg and Courtauld Institutes* 15 (1951) 198–228.
- DUCHESNEAU F., *La physiologie des Lumières. Empirisme, modèles et theories* (The Hague: 1982).
- FRIED M., *Absorption and Theatricality. Painting and Beholder in the Age of Diderot* (Berkeley: 1980).
- GREEN F. (ed.), *Diderot's Writings on the Theatre* (New York: 1987).
- HELSDINGEN H.W. VAN, "Laocoön in the Seventeenth Century", *Simiolus* 10, 2/3 (1978–1979) 127–141.
- JONES A., "Body", in Nelson R.S. (ed.), *Critical Terms for Art History* (Chicago-London: 2002) 251–265.
- KOHLE H., *Ut Pictura Poesis non erit. Denis Diderots Kunstbegriff* (Hildesheim: 1989).
- LICHTENSTEIN J. – MICHEL C. (eds.), *Conférences de l'Académie royale de Peinture et de Sculpture* (Paris: 2006), vol. 1.
- MAGNIEN A., *La nature et l'antique, la chair et le contour. Essai sur la sculpture française du XVIII<sup>e</sup> siècle*. SVEC (Oxford: 2004).
- MAINZ V. – WILLIAMS R., *Sensing Sculpture at the Time of the French Revolution* (Leeds: 2006).
- MICHEL C., "Anatomie d'un chef d'oeuvre: Laocoön en France au XVII<sup>e</sup> siècle", in Décultot E. – Rider J. le (eds.), *Revue Germanique Internationale* 19: *Le Laocoön. Histoire et réception* (2003) 105–117.
- MONIER P., "Sur les muscles du Laocoön", in Lichtenstein J. – Michel C. (eds.), *Conférences de l'Académie royale de Peinture et de Sculpture* (Paris: 2006), vol. 1, 581–593.

- REES J., "Der Apoll vom Belvedere und die Laokoon-Gruppe im Spektrum von Kunsttheorie und Antikrezeption im 18. Jahrhundert", in Mai E. – Wettengl K. (eds.), *Wettstreit der Künste. Malerei und Skulptur von Dürer bis Daumier* (Munich: 2002) 153–169.
- REY R., *Naissance et développement du vitalisme en France de la deuxième moitié du 18<sup>e</sup> siècle à la fin du Premier Empire* (Oxford: 2000).
- RISKIN J., *Science in the Age of Sensibility. The Sentimental Empiricists of the French Enlightenment* (Chicago-London: 2002).
- ROBERTS M.M. – PORTER R. (eds.), *Literature and Medicine during the Eighteenth Century* (London: 1993).
- ROUSSEAU G.S., *Enlightenment Borders. Pre-and Post-modern Discourses, Medical, Scientific* (Manchester: 1991).
- , *Enlightenment Crossings. Pre- and Post-modern Discourses, Anthropological* (Manchester: 1991).
- SCHENKER A.M., *The Bronze Horseman. Falconet's Monument to Peter the Great* (New Haven-London: 2004).
- SEZNEC J., *Salons de Diderot* (Oxford: 1957–1967).
- SONDEREN P.C., *Het sculpturale denken. De esthetica van Frans Hemsterhuis* (Leende: 2000).
- STAFFORD B., *Body Criticism. Imagining the Unseen in Enlightenment Art and Medicine* (Cambridge, Mass.: 1991).
- STAROBINSKI J., *Diderot dans l'espace des peintres* (Paris: 1991).
- VILA A.C., *Enlightenment and Pathology. Sensibility in the Literature and Medicine of Eighteenth-Century France* (Baltimore-London: 1998).
- WILLIAMS E., *The Physical and the Moral. Anthropology, Physiology, and Philosophical Medicine in France, 1750–1850* (Cambridge: 1994).
- WOLFE C.T. – TERADA M., "The Animal Economy as Object and Program in Montpellier Vitalism", *Science in Context* 21, 4 (2008) 537–579.





PART TWO

BLOOD



## BLOOD, CLOTTING AND THE FOUR HUMOURS

Hans L. Haak

### *Summary*

In view of the huge amounts of blood taken by bloodletting from Antiquity to the nineteenth century, one wonders how the physician handled the resulting product. In the Hippocratic Collection observations on clotted blood are rare. Did the ancient Greeks derive their ideas on the bodily humours by inspecting the coagulation process? Or were these interpretations developed during medieval times? How were these views modified during the Enlightenment? Can modern investigations throw light on the various historical reports? This paper, written from the point of view of a medical professional, takes a broad approach to several recorded observations from Antiquity to the present day.

In this paper, I will be examining accounts of the appearance of phlebotomised blood after coagulation. In view of the amounts that have been removed since Antiquity, medical practitioners through many centuries must have watched the irreversible change in its appearance and substance. How has their interpretation changed over time? It should be noted that this is not meant to be a complete overview of the subject.

I would like to start chronologically backwards with a quote from Rudolf Virchow's *Die Cellularpathologie* (1858). He studied the morphology of coagulation in detail; in his book two drawings are included showing the result of clotting *in vitro* and the presence of fibres in the clot. He writes that:

... wir nur zweierlei Arten von Fasern haben, welche mit ihnen eine naehere Aehnlichkeit darbieten. Die eine Art kommt in einer Substanz vor, welche sonderbarer Weise die aeltesten, vollkommen antiken, kraseologischen Vorstellungen mit den modernen annaehert, naemlich im Schleim. In der alten hippokratischen Medizin geht bekanntlich die ganze Fibrin-Masse noch unter dem Begriff des *Phlegma*, *Mucus*, und wenn wir den Schleim mit dem Faserstoff vergleichen, so muessen wir zugestehen, dass in der That eine grosse formelle Uebereinstimmung in der Ausscheidung besteht.<sup>1</sup>

Virchow describes the layers that occur after coagulation, from top to bottom: clear serum, a whitish thin layer and a red thick clot. He shows that

---

<sup>1</sup> Virchow R., *Die Cellularpathologie* (Berlin: 1858) 124.

the whitish layer, presently known as the 'buffy coat', consists of white blood cells and fibres that are shown in a separate drawing. The question is: to whom in Antiquity is Virchow referring, as he does not quote a specific source?

### *Antiquity*

In the Hippocratic Corpus we find several passages that might meet this requirement. In *Diseases* 2.8 (7.16 L.) coagulation of the blood *in vivo* is associated with the influx of *phlegm* in the blood vessels. But the text seems to be a theoretical account, not an actual description. The author of *Diseases* 4.51 (7.584 L.) explains diseases by a major disturbance in all of the bodily fluids (*tou hugrou pantos*) *in vivo*. He compares the result with the way the Scythians prepare butter and cheese from horse milk by churning; thus, bile separates to the surface, the second level down is blood, the third is composed of phlegm, and water, being heavier than all of these, is at the lowest level. But this description, too, does not appear to be based on the observation of clotting blood. In *Sacred Disease* 10 (6.378 L.) coagulation of blood, together with separation of *phlegma*, is held responsible for epileptic fits. According to *Places in Man* 30 (6.322 L.) a sore throat is caused by local clotting in the cervical veins.

Observations on clotted blood *in vitro* (i.e. outside the living body) have not come down to us in the Hippocratic writings, in contrast to the many descriptions there of uroscopy. The association of fibres and coagulation is indicated in *Fleshes* 8 (8.594 L.): if the container is shaken, blood does not coagulate because the cold and sticky fibres are removed. This statement is not followed up by any medical application, however. The removal of fibrous material from blood by whipping with a branch in order to keep it liquefied is also described by Plato (*Timaeus* 85c–e) and Aristotle (*Parts of Animals* 2.4, 650b). According to Ekroth this procedure was performed during sacrificial rituals at the temple since archaic times.<sup>2</sup> This author also suggests this was how blood was prepared for consumption, as mentioned in Athenaeus's *Deipnosophistae* where black pudding

---

<sup>2</sup> Ekroth G., "The Sacrificial Rituals of Greek Hero-cults in the Archaic to the Early Hellenistic Periods", *Kernos*, suppl. 12 (2002) 242–251.

is prepared from fried pieces of meat and blood whipped with honey and other ingredients.<sup>3</sup>

Many Hippocratic treatises agree that blood consists of a light fluid part and a firm heavier part. Duminil, who studied these reports in detail, points out that Aristotle argues that cooling alone cannot explain the clotting of blood, because bile does not coagulate *in vitro*. In contrast to the majority of the Hippocratic authors, Aristotle concludes that specific other qualities (for example, dryness) of the blood are the primary factors.<sup>4</sup> Thus, no Hippocratic origin can be found for Virchow's statement.

Galen may have alluded to the separation of a white layer within clotting blood in *On the Elements according to Hippocrates*, when he wrote about the different colours and qualities of blood, whether or not these contained fibres; he noticed that the colour of this blood (*haima*) can vary from *eruthron* (red) to *xanthoterion* (rather ruddy) to *melanterion* (dark) and he adds that 'sometimes there grows something whitish on the surface of it'.<sup>5</sup> This suggests that 'blood' indicates here only the thick heavier part, and Galen even exclaims:

Sometimes the whole of it appears livid, often even black, by Jove, like some deep purple dye; therefore blood is not just one thing.<sup>6</sup>

This strengthens our view that Galen describes various colours of the thick red layer. Here he does not relate them to different disease-states, but uses them as evidence for the complexity of blood as a whole, analogous to the curdling of milk resulting in cheese (*turos*) and whey (*oros*). He compares the *ichôr* from the blood with this whey. In *On Black Bile* he described the clotting of blood obtained by phlebotomy in more detail:

Phlegm sometimes appears to float on the surface of the blood, whilst in contrast the blood (or mass) as a whole can seem so thick and dark that it resembles raw pitch. (translation M. Grant).<sup>7</sup>

<sup>3</sup> Athenaeus, *Deipnosophistae* 6.324 'ὑπόσφαγμα δ' εἶναι κρέασιν ὅποῖς ἐκ τοῦ αἵματος τεταραγμένου μέλιτι κτλ'.

<sup>4</sup> Duminil M.-P., *Le sang, les vaisseaux, le coeur dans la Collection Hippocratique* (Paris: 1983) 226.

<sup>5</sup> Galenus, *De elementis secundum Hippocratem* 2.2 (1.496 K.) 'ἔστιν ὅτε δὲ καὶ σαφῶς ἐπανθεῖ τι λευκὸν αὐτῷ'.

<sup>6</sup> Galen, *De elem. sec. Hipp.* 2.2 (1.497 K.): 'καὶ ποτε πελιδνὸν ἅπαν ἐφάνη καὶ νῆ Δία γε πολλάκις ἐγγὺς τῷ μέλανι καθάπερ τις πορφύρα κατακορῆς, ὥστ' οὐχ ἔν ἀκριβῶς τὸ αἷμα'; de Lacy (1996) 145.

<sup>7</sup> Galenus, *De atra bile* 2 (5.107 K.): 'φαίνεται δὲ ἐνίοτε καὶ φλεγματώδη χυμὸ ἐποχούμενο τῷ αἵματι, καθάπερ γε καὶ ὑμῶν ἱκανῶ παχύτερόν τε καὶ μελάντερον, ὡ ἐοικέναι πολλάκι ὕγρῳ πίττῃ'; Grant (2000) 20.

Here again it appears that Galen sees the red thick part as the 'blood'. The thin fluid that is separated during congealing (*hugrôtês leptâ*) lies on top. It is derived from drinking (*ek tou potou*), mixed with the blood in the liver and transported to the urine or sweat. It is not clear whether he distinguishes this fluid from 'phlegm'. The wording suggests that what is called now the 'buffy coat' is indicated as *phlegmatôdês chumos*, which apparently does not always appear on top of the precipitated 'blood'. In other writings he stipulates that the word 'blood' is used in two different senses:

we talk about blood in two ways, sometimes as logically distinguished from the other humours, that is to say the phlegm and both biles; sometimes, from its dominant element, as the total fluid in the blood vessels. As the phlegm and the rest are part of it, it is clear that we are talking about one fluid.<sup>8</sup>

Galen reiterates a similar opinion in *On Hippocrates' Nature of Man* 1 (15.73–74 K.); he does not, however, solve this ambiguity. It is clear that in these passages he does not report on actual observations, but instead ponders theoretical considerations.

### *Middle Ages*

Moving on to the Middle Ages, we find that Avicenna (ca 1000 AD), in his *Liber canonis*, described blood left to clot in a container (*catin(us)*), resulting in various layers. Yellow bile (*cholera rubea*) is equated with a foamy layer in the top of the clot, and black bile with the lowest part that looks like dregs and turbid matter (*sicut fex et res turbida*). What looks like the white of an egg (*albumen ovi*) is *phlegm*; the supernatant watery part (*pars aquosum superfluitas*) is to be passed into the urine; and the remainder is 'blood' (*residuum vero est sanguis*).<sup>9</sup> This seems to be the first attempt to make an explicit connection between the four 'humours' and the components visible in clotted blood. The fact remains, however, that the Canon is a compilation of earlier writers, rather than representing

<sup>8</sup> Galenus, *In Hippocratis librum de alimento commentarii* 3 (15.262 K.) 'διττῶς δὲ τὸ αἷμα λέγεται, ἐνίοτε μὲν ἀντιδιαρούμενον πρὸς τοὺς ἄλλους χυμοὺς, τουτέστι πρὸς τὸ φλέγμα καὶ ἀμφοτέραν χολήν, ἐνίοτε δὲ κατ' ἐπικράτειαν ὅλος ὁ ἐν τοῖς ἀγγείοις χυμός. νῦν δὲ προστιθεὶς καὶ φλέγμα καὶ τὰ λοιπὰ δῆλός ἐστι σημαίνειν τὸν ἓνα χυμόν'.

<sup>9</sup> Avicenna, *Liber canonis* (Venice, P. De Paganis: 1507) 6, and Gruner O.C., *A Treatise on the Canon of Medicine of Avicenna* (London: 1930) 87.



Avicenna's own observations.<sup>10</sup> Nevertheless, this view was taken up in the Middle Ages by many authors.

The oldest medieval treatise in Europe that has come down to us is *De phlebotomia* by Maurus, a physician who practised in Salerno during the second half of the twelfth century. It was edited by Buerschaper in 1919 and is included in a study on medieval Blutschau by Lenhardt in 1986. The last section is entitled 'De sanguine' and opens as follows:<sup>11</sup>

The way to inspect blood is fourfold. When the blood flows, notice its quality before it has congealed and after coagulation. During the flow it should be noted whether it behaves as very thick (viscous) or very fluid or intermediate.<sup>12</sup>

The whole procedure involved most of the senses: smell, taste, touch and sight. I shall focus here on the last of these aspects.

After clotting (in a bowl) a supernatant fluid (*humiditas*) separates from the clot; this should not be too much nor too little, as the former indicates too much fluid in the body, and the latter dryness. This 'serum' has a colour similar to urine, if it is carefully collected without including any other parts of the blood. If the colour differs from that of the urine, it is a bad sign. In fact, the serum is thought to return to the liver and leave the body through the bladder (*redit ad hepar et exit per vesicam*).<sup>13</sup> It should be remembered that Maurus also produced a book on the inspection of urine.

The speed of the clotting process in the bowl (*in vase receptus*) is also to be documented and compared with the blood of healthy men (*quanto debeat fieri tempore per sanorum sanguinis inspectionem habet dinosci humiditas digesta*).<sup>14</sup> Of particular importance appears to be the following point: 'If the blood is foamy and has been shed with force, this indicates that it is poisonous and disorderly'.<sup>15</sup> However, in two other manuscripts

<sup>10</sup> Ullmann M., *Islamic Medicine* (Edinburgh: 1978) 45–46.

<sup>11</sup> Buerschaper R., *Ein bisher unbekannter Aderlasstraktat des Salernitaner Arztes Maurus. 'De Flebotomia'* (Leipzig: 1919) 23.

<sup>12</sup> 'Quadruplex est modus inspectione sanguinis. Cum enim sanguis fluit, considerandum, qualis et quando primo coaguletur et qualis sit post coagulationem. Quando fluit est inspicitur, ut eam sit nimis spissus vel nimis fluidus vel mediocriter se habeat'.

<sup>13</sup> Lenhardt F., 'Blutschau: Untersuchungen zur Entwicklung der Hämatoskopie', *Würzburger medizinhistorische Forschungen* 22 (1986) 19.

<sup>14</sup> Lenhardt, 'Blutschau' 20.

<sup>15</sup> 'Si sanguis sit spumosos et in impetus cadendi, significat ipsum esse venenosum et indigestum'.

the text here reads: 'If the blood is foamy and has *not* been shed with force [...].'<sup>16</sup>

This second reading makes more sense, since it suggests that spontaneous foaming indicates dangerous components in the blood. The clotted blood is further inspected from the top to the bottom: the surface should be level (*plana*), reddish (*ruffa*) and clearly separated (*claritate participans*); if it is not even (*inaequalis*) and does not adhere to the vessel when tilted (*non fuerit ex modo tenendi vas et inclinandi*), this is a bad sign, since it indicates that the parts are sparse or unripe (*significat enim parcium grossiciem*). If the colour of the surface is livid or ashen (*cinereus*) or fatty mixed with ash (*sepo mixtus cum cinere*), this points to corruption.<sup>17</sup> I would suggest that this fatty and ashen layer (light grey) is what we would call now the 'buffy' coat or 'Speckhaut'.

The next observation apparently concerns the coagulum itself after decanting the supernatant fluid (*aquositate proiecta*). If the clot can be easily split with a piece of wood (*cum lingo*), this shows that the blood is dry (*aridum*) like bread made from millet or other friable (*fragentibus*) materials.<sup>18</sup> On the cutting surface of the coagulum in normal blood, a colour-gradient can be recognised: from the top down, bright reddish (*rufus, multa claritate*) to *rubeus*, changing gradually to dark (*negridinem*). At the very bottom it should be black (*niger*), because that is its proper place (*quia infimum locum sui tenet*). If in the middle part one can observe a different colour, e.g. ashen or fat (*sepo*) mixed with ash, it is a bad sign. Maurus also stipulates that he cannot give the (optimal) relative proportions of these layers (*tamen non est determinandum, quanta proportio debeat*). In some people the blood looks like barley-gruel (*ptisanaria*), which is another bad sign.<sup>19</sup>

These observations have frequently been repeated during the Middle Ages, and several reports have been transmitted; for an overview here, I refer to Lenhardt's thesis. In these treatises the colours of the different layers in the clot are described almost uniformly: on top bright red, while at the bottom a dark layer (*niger* or *faex*) is associated with black bile. A white layer is described here – as it was earlier, by Avicenna – as *albumen ovorum*, and it is equated with *phlegma*. More confusing is the description of a layer of foam (*spuma*), equated with *colera rubra* (red or yellow bile).

<sup>16</sup> 'Si sanguis sit spumousus et non <sit> ex impetu cadendi [...].'

<sup>17</sup> Lenhardt, "Blutschau" 20.

<sup>18</sup> Lenhardt, "Blutschau" 21.

<sup>19</sup> Lenhardt, "Blutschau" 21–22.

The supernatant *pars aquosum* is not apparently related to the humours, but is excreted as urine.<sup>20</sup>

*Blutschau* was considered important for the diagnosis of leprosy, which may explain its relative popularity during the period of the leprosy epidemics (twelfth-fifteenth centuries). It should be noted, however, that *hematoscopy* never attained the status of *uroscopy* in diagnosis.

### *Enlightenment*

A few centuries later, we find Thomas Schwencke, who practised in The Hague, publishing *Haematologia sive sanguinis historia* in 1743. In this book he summarised and explained Harvey's *De motu cordis* and the more recent findings of Anthony van Leeuwenhoek concerning blood globules. It is probably the first monograph with 'haematology' in the title. He added several comments and his own observations and experiments. On normal blood left standing for 24 hours at room temperature (60° Fahrenheit) he noted:

The thick part of the blood should be contracted, although less so in the lowest part, the colour of the top layer should be bright, gradually turning to red towards the lower part, and on the bottom it is deep purple.<sup>21</sup>

He mocks those who believe that a mucus-like substance forming in the blood indicates phlegmatic, rotten or corrupted blood. A white coagulum develops in any venous blood when cold water is added, without a red clot forming (due to lysis of the red cells). Schwencke asks: 'What is this tough and leathery<sup>22</sup> crust, through which a knife can barely cut, that appears on top of the blood?'<sup>23</sup> It was usually observed in people with fevers and other complaints. However, the crust was also observed in people without any sickness or disease, and thus the question remains for Schwencke 'whether this crust is a cause of a present or future disease or its sequel?'<sup>24</sup>

<sup>20</sup> Lenhardt, "Blutschau" 42.

<sup>21</sup> Schwencke Th., *Haematologia, sive sanguinis historia, experimentis passim superstructa* (The Hague, Husson: 1743) 101 'Sanguinis crassamentum sit coherens, minus tamen in infima parte, superior color sit floridus, ad inferiorem partem redeoens paulatim rubicundior, in fundo purpureus'.

<sup>22</sup> The present designation 'buffy coat' also indicates its leathery nature: buff = chamois leather.

<sup>23</sup> Schwencke, *Haematologia* 155 'Quidnam sit illa crusta dura, coriacea, et vix cultro discindende quae apparet supra sanguinem'?

<sup>24</sup> Schwencke, *Haematologia* 156 'an crusta haec est causa morbi futuri, vel instantis vel ejus effectus'?

One thing is certain here: the crust is not part of the solid *cruor*, because Schwenke never saw the (red) cells of the *cruor* in the crust with a microscope.<sup>25</sup> Thus, during the Enlightenment, Schwencke described the macroscopy of clotted blood in the same way as the medieval authors, but unlike them he does not mention any association with the four classic humours, and nor does he refer to ancient or medieval medicine. In the eighteenth century many other new ideas on physiology were developed: for example, von Haller's vitalism and Galvani's electrophysiology.<sup>26</sup> As for pathology, Morgagni's *De sedibus et causis morborum* appeared in 1761.<sup>27</sup> The four humours were quickly losing their impact on medical theory, although the practices of bloodletting and cupping continued until the end of the next century. As we have seen, in the nineteenth century, Virchow tried to re-establish a link with Antiquity in the very book that led to the definitive demise of humoral pathology.

### *Twentieth century*

In 1921 Fahraeus published his thesis on 'the suspension-stability of the blood'. In the introduction he reflected on the macroscopic changes observed in clotting blood and the differences between healthy and sick donors. He took the position that the model of the four humours was somehow derived by the ancient Greeks from the observation of the clotting process itself:

As blood dies off through the cooling influence outside of the organism, these (parts) diverge from their intimate union. The black bile collects at the bottom (the dark coloured lower portion of the blood cake), the blood in a limited sense of the word, sanguis, rises towards the surface (the upper portion of the blood cake, florid from the oxygen of the air); the yellow bile gradually begins to free itself (the serum pressed out from the blood cake); the phlegm does not secrete itself spontaneously in healthy blood, but it is all the same present as the connective substance proper in the blood cake (fibrin) [...]. In unhealthy blood, however, the phlegm collected in a more

<sup>25</sup> Schwenke, *Haematologia* 155.

<sup>26</sup> Haller A. von, *Elementa physiologiae corporis humani* (Lausanne, Bousquet: 1757); Galvani L. *De viribus electricitatis in motu musculari commentarius* (Modena: 1792).

<sup>27</sup> Morgagni G.B., *De sedibus et causis morborum per anatomen indagatis libri quinque* (Venice, Remondini: 1761).

or less thick layer on the top of the blood cake, which was of course interpreted as being a consequence of this substance having increased.<sup>28</sup>

However, Fahraeus supported these opinions with references from the eighteenth century, rather than by direct quotes from the Hippocratic corpus or from Galen. In a later article (1947) he persisted in his views that the original four-humour hypothesis was triggered in Antiquity by careful observation of the clotting process of blood obtained by phlebotomy.<sup>29</sup> The whitish layer forming in certain conditions on top of the clot, the *crusta phlogistica* or 'buffy coat', was equated with the phlegma of the ancients, in a similar way to Virchow's arguments.

In her 1983 work, Duminil indicated that this theory might perhaps explain the importance of *phlegma*, but not the contribution of the two kinds of bile. In addition she feels that

il me semble que les quatre états du sang dans la coagulation dont parle R. Fahraeus n'existent pas simultanément et particulièrement que si on enlève la fibrine du sang, on ne verra pas apparaître le sérum.<sup>30</sup>

She also points out that none of the Hippocratic physicians documented observations of the blood of their patients suggesting that their disease was due to (excess of) *phlegma*.

Flashar, in an earlier criticism of the thesis of C. Vogel,<sup>31</sup> who held views similar to those of Fahraeus, noted that during clotting

sich [...] niemals vier Stadien beobachten lassen, da während des Gerinnungsprozesses keine Trennung von oxydiertem und reduziertem Blut eintritt. Es sind also nur drei Schichten unterscheidbar [...] <sup>32</sup>

Schöner, in his study on ancient humoral pathology, also questions the hypothesis proposed by Vogel and Fahraeus that observation of coagulating blood, rather than speculative natural philosophy, triggered the humoral theory.<sup>33</sup>

<sup>28</sup> Fahraeus R., *The Suspension-Stability of the Blood* (Stockholm: 1921) 9.

<sup>29</sup> Fahraeus R., "Die erhöhte Senkungsgeschwindigkeit der roten Blutkörperchen und ihre Bedeutung für die antike Humoralpathologie", *Bulletin der Schweizerischen Akademie der medizinischen Wissenschaften* 3 (1947) 67–80.

<sup>30</sup> Duminil, *Le sang* 227.

<sup>31</sup> Vogel C., "Zur Entstehung der hippokratischen Viersäftelehre", *Hippokrates* 24 (1956) 779–783.

<sup>32</sup> Flashar H., *Melancholie und Melancholiker in den medizinischen Theorien der Antike* (Berlin: 1966) 41.

<sup>33</sup> Schöner F., *Das Viererschema in der antiken Humoralpathologie* (Wiesbaden: 1964) 38–39.

But the story does not end here. In 1981 a review was published by H. Schmid-Schönbein: *Hemorheology and the experimental basis of classical humoral pathology*.<sup>34</sup> He showed that blood held in a wide container separates within about four hours into the layers described earlier: clear serum, whitish buffy coat and a red sediment. His description reads as follows:

A distinct layering was visible. On the bottom, a dark red (macroscopically almost black) layer of aggregated, deoxygenated red cells was seen, gradually extended into a layers with a lower hematocrit (thence [a lighter] red colour), which no longer changed after clotting. The retraction of the fibrin-platelet-clot leads to separation of the whitish buffy coat and the yellow serum.<sup>35</sup>

The author insists that this phenomenon can only be observed in patients with a high red cell sedimentation rate, e.g. in fevers or pregnancy. In normal conditions, usually only two layers are visible: serum and clot.

We should remember that in this 'simple' test two separate mechanisms operate simultaneously: cell-sedimentation and clotting. The first is a physical process, depending upon the 'suspension stability' in the blood plasma and gravity; the second is a chemical process triggered by the contact of blood with the glass receptacle, leading to a reaction-cascade of clotting factors, platelets and blood cells. In many diseases (e.g. fevers) a high sedimentation rate occurs, i.e. the most dense red cells drop down before being trapped in the clotting process. This layer is more compact and appears darker than the subsequent strata. Next, the lighter white cells and platelets float down upon this red cell cake. Finally the platelets and fibres sediment on this layer, consolidated by the coagulation-process. In normal blood these processes occur more or less simultaneously, leading to a mixed clot of all cells and fibres.

On the basis of these experiments Schmid-Schönbein agrees with the observations of the medieval authors, Schwencke and Fahraeus but, despite the title of his essay, he does not link his data with the 'humours' of Antiquity; instead he reviews the *therapeutic* effects of phlebotomy. He does not quote any of the authors from Antiquity, his oldest references dating from the seventeenth century.

---

<sup>34</sup> Schmid-Schönbein H., "Hemorheology and the Experimental Basis of Classical Humoral Pathology: An Essay", *Clinical Hemorheology* 1 (1981) 179–195.

<sup>35</sup> Schmid-Schönbein, "Hemorheology" 184.

*Conclusions*

I have argued here that, while the classical authors certainly observed the blood shed during phlebotomy, we cannot know whether they kept records of the clotting process *in vitro*. We can find an early, and explicit, mention of 'blood' as containing all four humours, linked to the various layers observed after clotting, in Avicenna's *Liber Canonis*, and during the later Middle Ages 'Blutschau' flourished in western Europe, starting in Salerno. In the eighteenth century Thomas Schwencke both observed and investigated a similar stratification in clotting blood, and was able to use the microscope to observe this; however, he did not make the connection with the classical humours. Virchow's statement that the *fibrous layer* represented *phlegma* did not originate in Antiquity but in the Middle Ages.

More recently, the link between the macroscopic stratification in clotted blood and ancient humoral pathology has been reinvestigated in the laboratory, the results showing that the medieval observations were essentially correct, but were probably only valid for blood taken from patients with inflammatory disease or pregnancy. This refinement of the earlier historical position should now be used by scholars trying to understand the views of the classical writers on the four humours.



*Selective bibliography*

- ATHENAEUS OF NAUCRATIS, *Dipnosophistarum libri XV*, ed. Kaibel G. (Leipzig: 1887).  
 AVICENNA, *Liber canonicus* (Venice, P. de Paganinis: 1507).  
 BUERSCHAPER R., *Ein bisher unbekannter Aderlasstraktat des Salernitaner Arztes Maurus: De Flebotomia* (Leipzig: 1919).  
 DUMINIL M.-P., *Le sang, les vaisseaux le cœur dans la collection Hippocratique* (Paris: 1983).  
 EKROTH G., "The Sacrificial Rituals of Greek Hero-cults in the Archaic to the Early Hellenistic Periods", *Kernos* suppl. 12 (2002).  
 FAHRAEUS R., "Die erhöhte Senkungsgeschwindigkeit der roten Blutkörperchen und ihre Bedeutung für die antike Humoralpathologie", *Bulletin der Schweizerischen Akademie der medizinischen Wissenschaften* 3 (1947) 67–80.  
 —, *The Suspension-Stability of the Blood* (Stockholm: 1921).  
 FLASHAR H., *Melancholie und Melancholiker in den medizinischen Theorien der Antike* (Berlin: 1966).  
 GALEN, *Opera omnia*: ed. Kühn C.G., 20 vols. (Leipzig: 1821–1833).  
 GRUNER O.C., *A Treatise on the Canon of Medicine of Avicenna* (London: 1930).  
 HIPPOCRATES: ed. Littré E. (1839–1861), *Œuvres Complètes d'Hippocrate*, Paris.  
 LENHARDT F., "Blutschau: Untersuchungen zur Entwicklung der Hämatoskopie", *Würzburger medizinhistorische Forschungen* 22 (1986).  
 SCHMID-SCHÖNBEIN H., "Hemorheology and the Experimental Basis of Classical Humoral Pathology: An Essay", *Clinical Hemorheology* 1 (1981) 179–195.  
 SCHÖNER E., *Das Viererschema in der antiken Humoralpathologie* (Wiesbaden: 1964).  
 SCHWENCKE THOMAS, *Haematologia, sive sanguinis historia, experimentis passim superstructa* (The Hague, Husson: 1743).  
 ULLMANN M., *Islamic Medicine* (Edinburgh: 1978).  
 VIRCHOW R., *Die Cellularpathologie* (Berlin: 1858) [reprint Hildesheim: 1966].

AN ISSUE OF BLOOD. THE HEALING OF THE WOMAN WITH THE  
HAEMORRHAGE (*MARK* 5.24B–34; *LUKE* 8.42B–48; *MATTHEW* 9.19–22)  
IN EARLY MEDIEVAL VISUAL CULTURE

Barbara Baert, Liesbet Kusters and Emma Sidgwick

*Summary\**

The textual and visual tradition of the story of the woman with the haemorrhage (*Mark* 5.24b–34), the so-called *Haemorrhissa*, is related in a specific way to Christ's healing miracles, but also to conceptions of female menstrual blood. We notice that with regard to the specific 'issue of blood' of the *Haemorrhissa* there is a visual lacuna in the specific iconography that developed around the story from early Christian times: in the transposition from text to image, there is no immediate depiction of her bleeding. However, the early-medieval reception of the story also became an important catalyst for uterine taboos, menstruation and its relation to magical healing, understood as a system of health practices. In this context, the dissemination of the motif in everyday material culture clearly points to a deep-rooted connection to uterine and menstrual issues. The paper considers both expressions and their – anthropologically framed – relation to this female 'issue of blood', which the *Haemorrhissa* came to embody and epitomise literally, as well as figuratively.

*Introduction*

Among the miraculous healings of the Bible, the story of the *Haemorrhissa* (the haemorrhaging woman) holds a special place (*Mark* 5.24b–34). The healing takes place through touch, at the initiative of the sick person herself, in this case a woman who had been suffering from haemorrhages for twelve years. The synoptic gospels suggest that this initiative on the woman's part is something that, in this period, was seen as crossing the boundaries of decency. Moreover, this touching was experienced as a charged undertaking. Christ felt a certain power flow from himself, as

---

\* This article is part of the research project *The Haemorrhaging Woman (Mark 5:24–34 par.)*. An Iconological Research into the Meaning of the Bleeding Woman in Medieval Art. Also a Contribution to the Blood and Touching Taboo before the Era of Modernity – funded by a Research Grant of the University of Leuven (2008–2012). Copy-editing by Paul Arblaster.

if the woman's touch took something away from him. The synoptic text thus holds considerable complexity: there is a remarkable relationship between touching and healing, and it involves a woman of whom several exegetical commentaries on the text suggest that she is – because of the specificity of her illness, her so-called 'issue of blood' – impure by law. In addition, the episode is framed within the context of another miracle: the raising of Jairus' daughter.

This chapter treats the theme of the Haemorrhissa as located in the interstices of exegesis, iconology and anthropology, with an interdisciplinary focus on the issue of blood. The first part – 'Text and intertext: what kind of bleeding?' – pursues the exegetical question of the specific nature of the 'issue of blood'. In the second part – 'From narrative to iconic space: the lacuna of the issue of blood' – we will confront this analysis with the genesis of the motif of the Haemorrhissa in art, from which the depiction of the issue of blood is absent. The third part – 'Healing and amulets: the motif's dissemination' – will examine the movement of the Gospel miracle story into the world of everyday material culture. The motif will therefore be situated in the anthropological context of blood, uterine taboos and magical healing. We understand magical healing<sup>1</sup> in this late antique context as a system of health practices based on the exploitation and manipulation of impersonal coercive forces at work in the world, bearing in mind that in late antique times magic, miracle and medicine were competitive in their relation to healing, but that at the same time the distinction between them was blurred.

---

<sup>1</sup> Ogden D., *Magic, Witchcraft and Ghosts in the Greek and Roman Worlds. A Sourcebook* (Oxford: 2009) 4 notes that the definition of 'magic' is 'famously problematic', since there is no consensus in defining the term, which has been in use since Antiquity. This is partly due to the history of magic itself, revealing crucial shifts in how magic was conceptualised and in the understanding of how it worked. Scholars currently tend to look at how magic was understood and worked in particular instances. See also Collins D., *Magic in the Ancient Greek World* (Malden: 2008) and Labahn M. – Lietaert Peerbolte B.J. (eds.), *A Kind of Magic. Understanding Magic in the New Testament and its Religious Environment* (London: 2007). We therefore use a heuristic definition of late antique magic as a system of health, following Kee H.C., *Medicine, Miracle and Magic in New Testament Times* (Cambridge: 1986) 3: 'Magic is a technique, through word or act, by which a desired end is achieved, whether that end lies in the solution to the seeker's problem or in damage to the enemy who has caused the problem', or further, as in contrast to the (Christian) miracle supplicated from the divine and understood as personal, 123: 'In the realm of magic the basic assumption is that there is a mysterious, inexorable network of forces which the initiated can exploit for personal benefit, or block for personal protection'. Magic's relation to the cause or onset of sickness or disability reflects this: such situations result from invisible, coercive forces (gods and all other powers) at work in the world, or from a magical curse. See also Greenwood S., *The Anthropology of Magic* (Oxford: 2009).

In the final section, by way of conclusion, we retrace the course of the motif from story to iconography to performative reception in everyday material culture, highlighting how the issue of blood became embedded in different cultural contexts and concurrently held different meanings.

*Text and intertext: what kind of bleeding?*

The episode of the Haemorrhissa is told in the synoptic gospels: *Mark* 5.24–34; *Luke* 8.42–48 and *Matthew* 9.19–22.<sup>2</sup> The story is framed within the story of Christ's resurrection of Jairus' daughter and takes place when Jesus has crossed the Sea of Galilee, namely on the west bank, on Jewish soil. The Haemorrhissa steps forward from the crowd of people as a nameless woman with her own internal desire: to be healed of the haemorrhages from which she has been suffering for twelve years. She believes this will happen as soon as she touches Christ's clothes. In the New Revised Standard Version, *Mark* 5.24b–34 reads as follows:

---

<sup>2</sup> The Haemorrhissa is discussed in the following exegetic and biblical historical studies: D'Angelo M.R., "Gender and Power in the *Gospel of Mark*: The Daughter of Jairus and the Woman with the Flow of Blood", in Cavadini J.C. (ed.), *Miracles in Jewish and Christian Antiquity. Imagining* (Notre Dame: 1999) 83–109; Fonrobert C., *Menstrual Purity. Rabbinic and Christian Reconstructions of Biblical Gender* (Stanford: 2000); Fonrobert C., "The Woman with a Blood-Flow (Mark 5.24–34) Revisited: Menstrual Laws and Jewish Culture in Christian Feminist Hermeneutics", in Evans C.A. – Sanders J.A. (eds.), *Early Christian Interpretation of the Scriptures of Israel. Investigations and Proposals* (Sheffield: 1997) 121–140; Haber S., "A Woman's Touch: Feminist Encounters with the Hemorrhaging Woman in Mark 5.24–34", *Journal for the Study of the New Testament* 26, 2 (2003) 171–192; Horsley R.A., *Hearing the Whole Story. The Politics of Plot in Mark's Gospel* (Louisville: 2001); Lemarquand G., *An Issue of Relevance. A Comparative Study of the Story of the Bleeding Woman (Mk 5:25–34; Mt 9:20–22; Lk 8:43–48) in North Atlantic and African Contexts* (New York: 2004); Levine A.-J., "Discharging Responsibility: Matthean Jesus, Biblical Law and Hemorrhaging Woman", in Bauer D.R. – Powell M.A. (eds.), *Treasure New and Old. Recent Contributions to Matthean Studies* (Atlanta: 1996) 379–397; Marcus J., *Mark 1–8. A New Translation with Introduction and Commentary* (New York: 2000); Oppel D., *Heilsam erzählen – erzählend heilen. Die Heilung der Blutflüssigen und die Erweckung der Jairustochter in Mk 5,21–43 als Beispiel markinischer Erzählfertigkeit* (Weinheim: 1995); Plaskow J., "Antijudaism in Feminist Christian Interpretation", in Schüssler Fiorenza E. (ed.), *Searching the Scriptures. A Feminist Introduction* (New York: 1993) 117–129; Schüssler Fiorenza E., *In Memory of Her. A Feminist Theological Reconstruction of Christian Origins* (New York: 1994) 124; Selvidge M.J., *Woman, Cult, and Miracle Recital. A Redactional Critical Investigation on Mark 5:24–34* (London: 1990); Selvidge M.J., "Mark 5:25–34 and Leviticus: A Reaction to Restrictive Purity Regulations", *Journal of Biblical Literature* 104, 4 (1984) 619–623; Struthers Malbon E., "Narrative Criticism: How Does the Story Mean?", in Anderson J.C. – Moore S.D. (eds.), *Mark and Method. New Approaches in Biblical Studies* (Minneapolis: 1992) 23–49; Trummer P., *Die Blutende Frau. Wunderheilung im Neuen Testament* (Freiburg: 1991) 15–21.

And a large crowd followed him and pressed in on him. [25] Now there was a woman who had been suffering from haemorrhages for twelve years. [26] She had endured much under many physicians, and had spent all that she had; and she was no better, but rather grew worse. [27] She had heard about Jesus, and came up behind him in the crowd and touched his cloak, [28] for she said, 'If I but touch his clothes, I will be made well'. [29] Immediately her haemorrhage stopped; and she felt in her body that she was healed of her disease. [30] Immediately aware that power had gone forth from him, Jesus turned about in the crowd and said, 'Who touched my clothes?' [31] And his disciples said to him, 'You see the crowd pressing in on you; how can you say, 'Who touched me?' [32] He looked all round to see who had done it. [33] But the woman, knowing what had happened to her, came in fear and trembling, fell down before him, and told him the whole truth. [34] He said to her, 'Daughter, your faith has made you well; go in peace, and be healed of your disease'.<sup>3</sup>

Some exegetes point to a number of interesting connections linking the story of the Haemorrhissa to that of Jairus' daughter. The Jairus story frames the episode of the Haemorrhissa, which forces a 'tormenting delay' on its frame story: it is precisely because of this woman that Jesus arrives too late for Jairus' daughter.<sup>4</sup> The Haemorrhissa episode functions as a dramatic interruption that is taken from Jesus but which he also considers a necessity: he pauses to find her. Mark has probably established a number of symbolic relationships and contrasts between the twelve-year old girl and the twelve years that the woman had been undergoing ineffective treatment. The number twelve itself can also refer to the twelve tribes of Israel. The girl faces the beginning of her menses while the woman is healed through the stopping of the flood.<sup>5</sup> One crowd hinders healing, the other makes healing possible. Jairus is rich, but the Haemorrhissa is poor

---

<sup>3</sup> 'Et abiit cum illo, et sequebatur eum turba multa, et comprimebant eum. Et mulier, quæ erat in profluvio sanguinis annis duodecim, et fuerat multa perpressa a compluribus medicis: et erogaverat omnia sua, nec quidquam profecerat, sed magis deterius habebat: cum audisset de Jesu, venit in turba retro, et tetigit vestimentum ejus: dicebat enim: Quia si vel vestimentum ejus tetigero, salva ero. Et confestim siccatus est fons sanguinis ejus: et sensit corpore quia sanata esset a plaga. Et statim Jesus in semetipso cognoscens virtutem quæ exierat de illo, conversus ad turbam, aiebat: Quis tetigit vestimenta mea? Et dicebant ei discipuli sui: Vides turbam comprimentem te, et dicis: Quis me tetigit? Et circumspiciebat videre eam, quæ hoc fecerat. Mulier vero timens et tremens, sciens quod factum esset in se, venit et procidit ante eum, et dixit ei omnem veritatem. Ille autem dixit ei: Filia, fides tua te salvam fecit: vade in pace, et esto sana a plaga tua'.

<sup>4</sup> Marcus, *Mark* 1-8 364-366.

<sup>5</sup> One could ask whether the Haemorrhissa is cured by menopause: her source dried up; Formanek R. (ed.), *The Meanings of Menopause. Historical, Medical and Clinical Perspective* (Hillsdale: 1990).

after losing all her money to medical treatment. Both women are called 'daughter' although they are both ritually impure: one because of death, the other because of menstruation. In *Numbers* 5.1–4 God commands Moses to expel from the camp both morbidly menstruating women (the so-called *zabâ*) and those who have touched corpses; in *Mark* 5 and *Luke* 8, however, Jesus touches, and restores to health, both a haemorrhaging woman and a dead girl. Both cases therefore develop a certain amount of tension with Jewish doctrine. Both cases, additionally, share the fact that fear is a significant emotion.

Exegetes today debate the nature of the healing (is it a miraculous or magical act?), its performance (the touching happened at the woman's initiative) and the possible anti-Judaic undertone of the episode (is *Mark* deliberately referring to a Jewish impurity law, i.e. to *Leviticus*?). The last point ties in with the fact that besides the problem of healing, magic and the miraculous act, there has been just as much controversy about the *nature* of the Haemorrhissa's illness, her 'issue of blood', as is explained by Richard A. Horsley: 'The importance of the woman who had haemorrhaging for twelve years [...] has been obscured in recent interpretation. Indeed, by setting Jesus in opposition to "Judaism", Christian theological interpretation has not only blocked recognition of important aspects of *Mark's* story, it has imposed some highly distorting false issues onto these episodes and the significance of these women. It is important to dispense with these distorting false issues in order to clear the way for a fresh hearing of these intertwined episodes'.<sup>6</sup> As the text makes no specific mention of vaginal bleeding, some exegetes have suggested that the bleeding could be due to other causes, even including chronic nosebleeds.<sup>7</sup> In current examinations of the Haemorrhissa episode, however, it is commonly accepted that the woman's bleeding was indeed of a *uterine* nature.<sup>8</sup> Indeed, the text literally says only 'a woman who had been suffering from haemorrhages for twelve years' (*mulier quae erat in profluvio sanguinis annis duodecimo*, *Mark* 5.25). The evangelist not only emphasises the duration and severity of the sickness, but also seems hesitant to locate the

<sup>6</sup> Horsley, *Hearing the Whole Story* 208.

<sup>7</sup> See for example D'Angelo, "Gender and Power" 101–102 and Levine, "Discharging Responsibility" 384. For an overview of differing opinions see also Loos H. van der, *The Miracles of Jesus* (Leiden: 1965) 509–510.

<sup>8</sup> A well-balanced position in this can be found in Marcus, *Mark* 1–8 357, and Robertson A.T. – Perschbacher W.J., *Word Pictures of the New Testament*, 1, *Matthew and Mark* (Grand Rapids: 2004) *passim*.

exact source. *Mark* 5.29, however, refers to the drying up of the 'source/fountain of her blood' (*fons sanguinis eius siccatus est*), a concept coming from *Leviticus* 12.7, 15.19–33 and 20.18, where the *zabâ*, a woman suffering from a menstrual disorder with abnormally heavy and prolonged loss of blood, is discussed.<sup>9</sup> An ancient Judaist substratum lingers in the text.

Be that as it may, literary sources irrefutably reveal that in early Christianity the Haemorrhoida was perceived as suffering from severe menstrual bleeding and was as such considered impure, and this was understood in the context of the early Christian concern with the presence of menstruating women in sacred space, another bloody realm due to the presence of Eucharistic blood.<sup>10</sup> In early Christianity there was tension between a very far-reaching taboo on the menstruating woman in Jewish circles and the attitude and reactions of Christians towards the Jewish views with which they came into contact.<sup>11</sup> The story of Hekhalot Rabbati 18 (third or fourth century) is typical of this Jewish obsession. A rabbi travels through heaven but is hurled on to the earth by another rabbi who had a small piece of wool on his knee that had been touched by a menstruating woman.<sup>12</sup> In Judaism menstrual blood is always impure; it is the consequence of the fall of man.<sup>13</sup>

In the *Didascalia Apostolorum*, a third-century Syrian text, the author again tries to convince newly-converted Jewish women not to withdraw from their place in the community while menstruating: 'You shall not separate those [women] who are in the wonted courses; for she also who

<sup>9</sup> Which, moreover, is Marla Selvidge's major argument concerning the issue of anti-Judaism in this passage.

<sup>10</sup> In research on the relationship between blood and space in the early Christian Latin West and Greek East, Joan Branham has published extensively: Branham J.R., "Sacred Space under Erasure in Ancient Synagogues and Early Churches", *Art Bulletin* 74, 3 (1992) 375–394; Branham J.R., "Blood and Sanctity at Issue", *Res. Anthropology and Aesthetics* 31 (1997) 53–70; Branham J.R., "Frauen und blutige Räume: Menstruation und Eucharistie in Spätantike und Mittelalter", *Vorträge Warburg-Haus* 3 (1999) 129–161; Branham J.R., "Bloody Women and Bloody Spaces", *Harvard Divinity Bulletin* (e-journal) 30/06/04; Branham J.R., "Penetrating the Sacred: Breaches and Barriers in the Jerusalem Temple", in Gerstel S. (ed.), *Thresholds of the Sacred. Architectural, Art Historical, Liturgical and Theological perspectives on religious Screens, East and West* (Cambridge: 2006) 6–24.

<sup>11</sup> See also Amt E. (ed.), *Women's Lives in Medieval Europe. A Sourcebook* (New York: 1993) 279–317; Fonrobert, *Menstrual Purity* 160–210.

<sup>12</sup> Marcus, *Mark* 1–8 357; Scholem G.G., *Jewish Gnosticism, Merkavah Mysticism and Talmudic Tradition* (New York: 1960) 10–12; Gruenwald I., *Apocalyptic and Merkavah Mysticism* (Leiden: 1980) 164.

<sup>13</sup> Cohen S., "Menstruants and the Sacred in Judaism and Christianity", in Pomeroy S.B. (ed.), *Women's History and Ancient History* (Chapel Hill, NC: 1991) 151–173; McCracken P., *The Curse of Eve, The Wound of the Hero. Blood, Gender and Medieval Literature* (Philadelphia, PA: 2003).



had the flow of blood was not chidden when she touched the skirt of our Saviour's cloak, but was even vouchsafed the forgiveness of all her sins'.<sup>14</sup> At the same time, however, Dionysius of Alexandria († 264), a student of Origen, says quite the opposite: 'Concerning women in their menstrual separation, whether it is right to them in such a condition to enter the house of God, I think it is unnecessary even to inquire. For I think that they, being faithful and pious, would not dare in such a condition either to approach the home table or to touch the body and blood of Christ'. In his argument, Dionysius explicitly refers to the woman who only touched the hem of Christ's mantle.<sup>15</sup>

And the controversy of the menses and the sacred space remains. When, in 597, Augustine of Canterbury asks whether a menstruating woman may receive communion, Gregory the Great answers as follows: 'A woman must not be prohibited from entering a church during her usual periods, for this natural overflowing cannot be reckoned a crime. If the woman who was suffering from the issue of blood humbly came behind the Lord's back and touched the hem of his garment [...] was justified in her boldness, why is it that what was permitted to one woman, was not permitted to all women?'<sup>16</sup> In 688, however, Theodore of Tarsus, later Archbishop of Canterbury, says that menstruating women are under no circumstances to receive communion, and also requires a waiting period before women who have given birth attend church.<sup>17</sup> Jonas of Orléans says

<sup>14</sup> *Didascalica Apostolorum* 26, 62, 5 'Nam et ea quae fluctum patiebatur, cum tetigisset salubrem fimbriam, non est repraehensa, sed tum sanata perfectam remissionem peccatorum meruit'. Connolly R.H., *Didascalica Apostolorum* (Oxford: 1929) 254.

<sup>15</sup> Dionysius of Alexandria, *Epistola Canonica ad Basilidem episcopum*, *Canon II*: ed. Migne J.P. (1857), *S.P.N. Gregorii, Cognomento Thaumaturgi, Opera Quae Reperiri Potuerunt Omnia*, Paris, 1282 'Interrogatus ergo sanctus de fidelibus mulieribus, an eas oporteat, quando a menstuis vexantur, ecclesiam ingredi, respondit non oportere hoc fieri; et mulierem quae sanguinis profluvio in Evangelio laborabat, in exemplum adduxit, non ausam Dominum tangere, sed solam ipsius fimbriam'; Cohen, "Menstruants" 288.

<sup>16</sup> Gregory the Great, *Epistola* 64: ed. Migne J.P. (1849), *Sancti Gregorii Papae I Cognomento Magni, Opera omnia*, Paris, col. 1194 'Quae tamen mulier dum ex consuetudine menstrua patitur, prohiberi ecclesiam intrare non debet, quia ei naturae superfluitas in culpam non valet imputari, et per hoc quod invita patitur, justum non est ut ingressu ecclesiae privetur. Novimus namque quod mulier quae sanguinis fluxum patiebatur, post tergum Domini humiliter veniens vestimenti ejus fimbriam tetigit, atque statim ab ea sua infirmitas recessit. Si ergo in fluxu sanguinis posita laudabiliter potuit Domini vestimentum tangere, cur quae menstruum sanguinis patitur, ei non liceat Domini ecclesiam intrare?' Wood C.T., "The Doctor's Dilemma: Sin, Salvation, and the Menstrual Cycle in Medieval Thought", *Speculum* 56, 4 (1981) 710–727, 713.

<sup>17</sup> Mc Neill J. – Gamer H.M., *Medieval Handbooks of Penance. A transtaion of the principal libri poenitentialis and selections from related documents* (New York: 1990) 179–217; Payer P.J., *Sex and the Penitentials. The Development of a Sexual Code 550–1150* (Toronto: 1984) 36.

in his *De institutione laicali*: 'Women do not enter the church during carnal impurity'.<sup>18</sup> In short, while a bridge is made from the early Christian period to Western Europe, whereby 'symbolically bloody realms remain inaccessible to physically bloody women', from another perspective, the Haemorrhissa was being marshalled in an attempt to turn the tide.<sup>19</sup>

Exegetic literature has brought forward some important cruxes in the text of the Haemorrhissa episode, and has also revealed background issues of historical relevance, such as the Levitical taboo of menstruation, positing *Leviticus* as an important intertext. These background issues are relevant for the semantics of the image and the iconographic tradition around the Haemorrhissa. It is as such remarkable that, in the transposition from text to image, to which we will now turn, Christian iconography crystallised around a remarkable lacuna: nowhere is the issue of blood directly depicted or represented.

*From narrative to iconic space. The lacuna of the issue of blood*

In his essay 'À distance', Carlo Ginzburg has inimitably discussed how the introduction of the Haemorrhissa into early Christian art cannot be separated from a fascination for what he calls the *punctum*: *l'instant décisive*.<sup>20</sup> In the interspace of image and word one finds 'moments of suction'. The moment that Christ's clothes are touched is joined together with the moment of healing (*fons sanguinis siccatus est*) and with the moment that Jesus feels a 'power' (*dynamis, virtus*) flowing from him and He looks back. In the condensation of energy around these verses (*Mark* 5.28–30, *Luke* 8.44–46), the opening towards the image presents itself. The texts tear open and the visual momentum escapes: *le point décisif*.

A third-century wall painting in the catacomb of Peter and Marcellinus shows one of the earliest depictions of the scene and reveals the image as crystallised out of those 'moments of suction' [Fig. 1].<sup>21</sup> The woman kneels behind Christ and longingly extends one hand to him, the other

<sup>18</sup> Jonas of Orléans, *De institutione laicali*: ed. Migne J.P. (Paris: 1851) cols. 187–188.

<sup>19</sup> Branham, "Bloody Women" 8.

<sup>20</sup> Ginzburg C., *A distance. Neuf essais sur le point de vue en histoire* (Paris: 1998) 101 'Ces images, concentrées sur le punctum, sur l'instant décisif'.

<sup>21</sup> The catacomb of Peter and Marcellinus contains a total of five wall paintings depicting the Haemorrhissa. See Deckers J.G. – Seeliger H.R. – Mietke G., *Die Katacombe "Santi Marcellino e Pietro"*. *Repertorium der Malereien* (Vatican-Münster: 1987) 223–226, 241–243, 309–318, 330–334.



Fig. 1. *Healing of the Haemorrhissa*, mural in the catacomb of Saints Peter and Marcellinus, third century. Rome.

hand supporting her chin in an expression of silent sadness and despair; He however already turns to her and blesses her. An ivory, part of the so-called Brescia Casket from the fourth century, consolidates the healing again in their mutual dialogue [Fig. 2]. The Haemorrhissa still touches his clothing while he already turns around and places his hand above her head. The conflation of both moments, the initiative of the woman and the experience of Christ on the one hand, and his approving blessing on the other hand, forms the basis of the most common formula in early Christian art, as seen on the sarcophagus of Adelpheia and Syrakus [Fig. 3] and a fifth-century sarcophagus from the archaeological museum in Istanbul [Fig. 4]. The latter repeats almost exactly the depiction of the scene in the catacomb of Peter and Marcellinus: the woman kneels on one knee and touches his clothing, he turns around and, in a gesture of blessing, his hand hovers above her head.

In these first iconographic instances we find no explicit references to the nature of the Haemorrhissa's illness. On the one hand, the iconography uses the conventions of the healing Saviour (the laying on of hands): on the other hand, it uses the elements of the story (a kneeling woman, the hem, the presence of the disciples). The figurative image is however limited in its representation of this intimate illness. In depictions of the healing of the blind man at Siloam (*John* 9.1–4) the eyes are pointed to, and in those of the paralytic at the *Piscina Probatica* (*John* 5.1–8) the bed or the crutch refer to the specific handicap.<sup>22</sup> But in the case of the Haemorrhissa nothing allows us to induce that the miracle involves a haemorrhage of the uterus. This can sometimes make her difficult to identify; she is often confused with Mary Magdalene, the woman of Canaan (*Matthew* 15.22) or the humpbacked woman (*Luke* 13.10–17).<sup>23</sup> In the miniature

<sup>22</sup> Baert B., "La Piscine Probaticque à Jérusalem: L'eau médicinale au Moyen Age", in Cardon B. (ed.), *"Als Ich Can". Liber Amicorum in Memory of Professor Dr. Maurits Smeyers* (Louvain: 2002) 91–129; Baert B., "The Healing of the Blind Man at Siloam, Jerusalem: A Contribution to the Relationship Between Holy Places and the Visual Arts in the Middle Ages", *Arte Cristiana* 838 (2007) 49–60; 839 (2007) 121–130; Baert B., "The Pool of Bethesda: The Cultural History of a Holy Place in Jerusalem", *Viator. Medieval and Renaissance Studies* 36 (2005) 1–22.

<sup>23</sup> On these confusions, see Knipp D., *'Christus Medicus' in der frühchristlichen Sarkophagskulptur. Ikonographische Studien der Sepulkalkunst des späten vierten Jahrhunderts* (Leiden: 1998); Bruyne L. de, *L'imposition des mains dans l'art chrétien ancien* (Vatican, Pontificio istituto di archeologia cristiana: 1943) 166–174. Due to the sometimes ambiguous postures, the Haemorrhissa is most of the time confused with the *Noli me tangere* motif. There is for instance no consensus on the depiction of the Brescia Casket. Noga-Banai G., *The Trophies of the Martyrs. An Art Historical Study of Early Christian Silver Reliquaries* (Oxford: 2008) 38–61. We are however convinced that an independent iconographic motif





Fig. 2. *Healing of the Haemorrhissa*, detail of the *Brescia Casket*, ca. 360–370. Ivory relief. Brescia, Museo Civico.



Fig. 3. *Healing of the Haemorrhoidissa*, detail of the Sarcophagus of Adelfia and Syrakus. Rome, ca. 340. Syracuse (Sicily), Museo Nazionale.





Fig. 4. *Healing of the Haemorrhoidissa*, detail of a sarcophagus, fifth century. Istanbul, Archaeological Museum.





Fig. 5. *Healing of the Haemorrhissa*, miniature in the *Codex Egberti* (Trier, 977–993). Trier, Stadtbibliothek (ms. 24, f. 90 verso).

of the *Codex Egberti*, the miniaturist countered confusion by adding above the woman: *fluxum habens* [Fig. 5].<sup>24</sup>

Did, however, this lacuna in the visual depiction of the motif give rise to any other means of suggesting the issue of blood? We have already mentioned that, in the gospels, the illness of the woman is compared to a *fons sanguinis*. When one considers the *passus* as an image of the wellspring,

for the *Noli me tangere* arose only from Carolingian times onwards. Baert B. – Kusters L., “The Twilight Zone of the *Noli me tangere*: Contributions to the History of the Motif (ca. 400–ca. 1000) in the West”, *Louvain Studies* 32 (2007) 255–308.

<sup>24</sup> Schiel H., *Codex Egberti der Stadtbibliothek Trier* (Basel: 1960); Ronig F.J., “Erläuterungen zu den Miniaturen des Egbert Codex”, in Dornheim S.D. (ed.), *Der Egbert Codex. Das Leben Jesu. Ein Höhepunkt der Buchmalerei vor 1000 Jahren* (Stuttgart: 2005) 122–124.

it suddenly becomes apparent how the haemorrhage is typologically combined with other biblical episodes and miracles related to wells, fountains and/or fluidity. In the catacomb of Peter and Marcellinus, another depiction of the Haemorrhissa is placed to the right of Moses striking water from the rock, and the paralytic at the *Piscina Probatica* in Jerusalem.<sup>25</sup> The sixth-century encolpion from Adana also places the woman alongside the healing at the *Piscina Probatica* [Fig. 6].<sup>26</sup> Again, another Haemorrhissa in the catacomb of Peter and Marcellinus is combined with the Samaritan woman at the well.<sup>27</sup> In a mosaic of Ravenna, the healing of the Haemorrhissa precedes the Samaritan.<sup>28</sup> On the sarcophagus of Celsus in Milan (fourth century) the Haemorrhissa is typologically combined with Peter, who turns the prison wall into water flowing [Fig. 7].<sup>29</sup> This proximity not only points obliquely to the specificity of the Haemorrhissa's issue of blood, it also articulates a contrast between a miraculous flowing and a miraculous drying up. Both cases feature a necessary restoration of nature for the sake of the individual and the community. The parallel that was drawn in this sarcophagus sets out a trail towards a deeper consciousness of the impact of the healing of the Haemorrhissa in the context of the Bible. In sum, the typological combination not only indirectly suggested the issue of blood; on another level, it also connected the motif to the paramount importance of Christian miraculous healing.

Christ's miracles were the dominant evangelical theme of early Christian imagery. In his book *The Clash of Gods. A Reinterpretation of Early Christian Art*, Thomas Mathews situates the miracles of healing in the context of a still ambivalent view of the Saviour.<sup>30</sup> The author makes an argument for the interpretation of the miracle stories as expressions of a view of the world that is still influenced by magic. The iconographic preoccupation – both quantitatively and qualitatively – with the miracles of healing can be seen as a powerful response to Antique traditions. It is not Asclepius, the wizard-God, who is central, but the Son of God, who

<sup>25</sup> *Healing of the Haemorrhissa*, mural in the catacomb of Saints Peter and Marcellinus (third century), Rome. Deckers, *Die Katacombe* cat. no. 64.

<sup>26</sup> Schiller G., *Iconography of Christian Art*, 1. *Christ's Incarnation, Childhood, Baptism, Temptation, Transfiguration, Works and Miracles* (London: 1971) 179.

<sup>27</sup> *Healing of the Haemorrhissa*, mural in the catacomb of Saints Peter and Marcellinus (third century), Rome. Deckers, *Die Katacombe* cat. no. 71.

<sup>28</sup> *Healing of the Haemorrhissa*, mosaic in the San Apollinare Nuovo (520–526), Ravenna. Schiller, *Iconography* fig. 431.

<sup>29</sup> Knipp, *Christus Medicus* 124–125.

<sup>30</sup> Mathews T.F., *The Clash of Gods. A Reinterpretation of Early Christian Art* (New Jersey: 1993) 65–66.

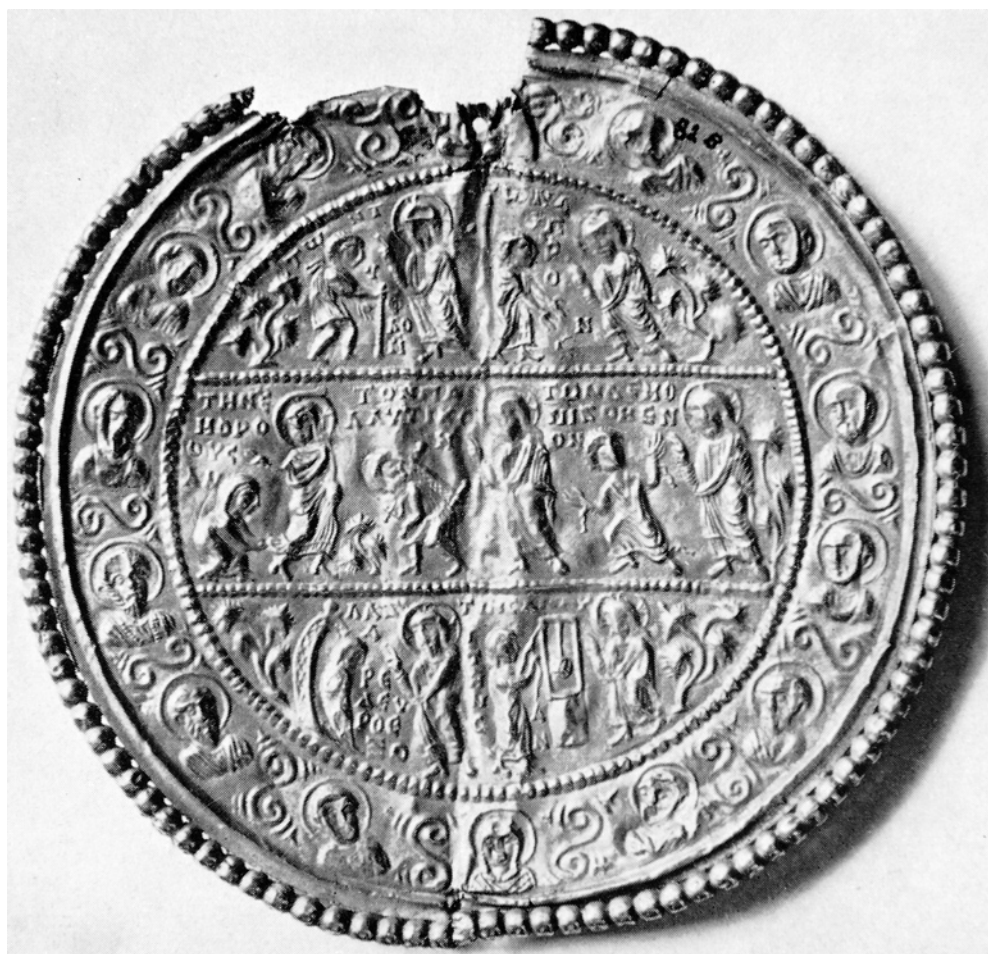


Fig. 6. *Healing of the Haemorrhoid, Encolpion from Adana, end of the sixth century.*





Fig. 7. *Peter turning the prison wall into water, Celsus sarcophagus, fourth century. Milan, S. Maria presso S. Celso.*

heals with one word, one touch, in the power of monotheism, uprooting the antique traditions. The apologetic character of the iconography on sarcophagi, for instance, consequently shows itself in depicting Christ as the 'true' magician. 'The force of the early Christian miracle images is their radical novelty [...]. The moment of the miracle is critical [...] this was a new kind of imagery, for which, surprisingly enough, non-Christian art had no answer. Paganism had no images to compare with this propaganda'.<sup>31</sup> When Origen (ca. 284) defends Christ against mocking heathens, he does not deny that Christ had gifts of magic, but rather defends him as a true healer who performed his magic without quackery and without asking a fee. Indeed, merely uttering his name could exorcise demons.<sup>32</sup>

Magic and, more specifically, magical healing was still very much alive in late Christian and early medieval times. This also explains the penetration of the theme of Christ the Healer into different kinds of imagery: sarcophagi, ceramics, jewellery, intaglios, amulets, and textiles. Asterius, Bishop of Pontus on the southern shore of the Black Sea, writes the following around 400: 'The more religious among rich men and women, having picked out the story of the Gospels, have handed it over to the weavers – I mean our Christ together with all his disciples, and each one of the miracles the way it is related. You may see the wedding of Galilee with the water jars, the paralytic carrying his bed on his shoulder, the blind man healed by means of clay, the woman with an issue of blood seizing Christ's hem, the sinful woman falling at the feet of Jesus, Lazarus coming back to life from his tomb. In doing this, they consider themselves to be religious and to be wearing clothes that are agreeable to God'.<sup>33</sup> It is precisely in the further early-medieval reception of the motif that profound connections to female menstrual and blood taboos surfaced most clearly and visibly;

<sup>31</sup> Mathews, *The Clash of Gods* 68.

<sup>32</sup> Origen, *Contra Celsum* 1,67–68; for an edition see Origen, *Contra Celsum*: tr. Chadwick H. (Cambridge: 1965) 62–63.

<sup>33</sup> Asterius of Amasia, *Homily 1*: ed. Migne J.P. (1858), *SS. Patrum Aegyptiorum Opera omnia*, Paris, col. 167 'Si qui autem cum viri, tum feminae ex iis, qui divitiis affluunt, religiosiores videntur, collecta ex historia evangelica argumenta, textoribus subministrant; ipsum inquam Christum nostrum cum discipulis omnibus; ac miracula, qua quodque ratione narratum habetur. Videbis nuptias Galilaeae et hydrias; paralyticum, lectum in humeris gestantem; caecum, oblito luto curatum; profluvio sanguinis laborantem feminam, fimbriam prehendentem; peccatricem, ad pedes Jesu accidentem; Lazarum e sepulcro ad vitam redeuntem: dumque haec faciunt, pie se facere, idque indumenti genus, quod Deo gratum sit, induere arbitrantur'; Mango C., *The Art of the Byzantine Empire 312–1453. Sources and Documents* (Englewood Cliffs: 1972) 51.

more specifically, in the dissemination of the motif on everyday material culture closely connected to nothing other than magical healing.

*Healing and amulets. The motif's dissemination*

It is possible that the frequent presence of the Haemorrhoid in early Christian iconography is linked to the fascination with the Lord of miracles himself, and thus links to an iconography that responds to a pragmatic and redeeming interpretation of Christ's message. The Haemorrhoid is a theme grounded in everyday material culture. One representation has been identified on the basis of her superscription on a fifth-century piece of cloth used not in a liturgical context, but as a household utensil [Fig. 8].<sup>34</sup> As one goes deeper into the material culture of the first Christians, one even finds the Haemorrhoid in the world of gems, spells, miraculous stones and amulets.<sup>35</sup> This crossing over of a gospel miracle story, appearing in classic sarcophagus cycles, to the world of gems and the apotropaion is astounding. We will attempt to identify the pattern behind this transfer below; again, it seems clearly and specifically to connect to the issue of blood.

A.A. Barb mentions an early Byzantine amulet in the British Museum, bearing Greek inscriptions, which features Christian iconography on one side and Gnostic-inspired iconography on the other [Fig. 9].<sup>36</sup> On the Christian side are four rows with biblical scenes and miracles of healing, among them the blind man at Siloam and the man healed of the palsy at the *Piscina Probatica*. In the middle of the third row, we find the Haemorrhoid, recognisable by her hands outstretched towards Christ's hem. The inscription asks for strength for its bearer and weakness for the enemy. On the Gnostic side, one recognises 'Horus on the crocodiles', an Egyptian magical image, and an inscription which together with Solomon and angels calls out: '*Sisinnos bisinnos* (sic)', 'she should not have strength any more'.

<sup>34</sup> Mathews, *The Clash of Gods* 60.

<sup>35</sup> Spier J., *Late Antique and Early Christian Gems* (Wiesbaden: 2007); Spier J., "Amulets", *Journal of the Warburg and Courtauld Institutes* 56 (1993) 25–62; Ritner R.K., "A Uterine Amulet in the Oriental Institute Collection", *Journal of Near Eastern Studies* 43, 3 (1984) 209–221.

<sup>36</sup> Barb A.A., "Three Elusive Amulets", *Journal of the Warburg and Courtauld Institutes* 27 (1964) 1–22, 10; fig. 2a–b.

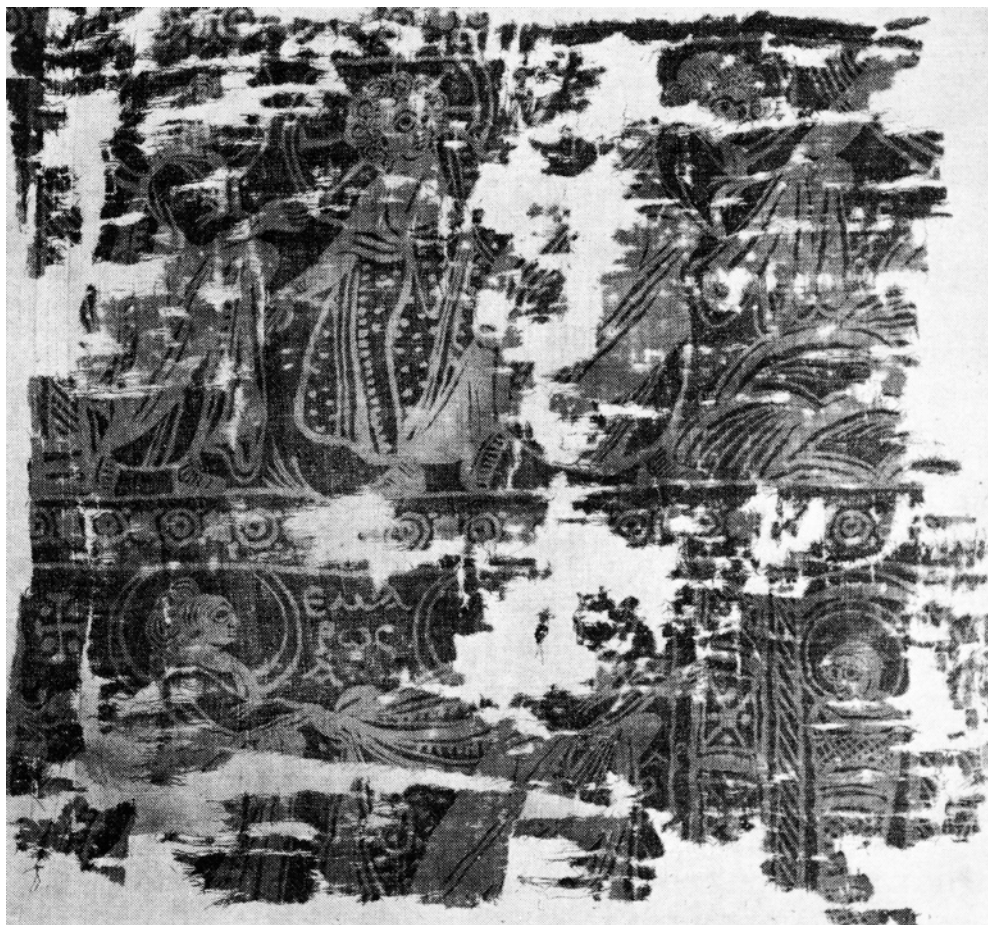


Fig. 8. *Resurrection of Lazarus and Healing of the Haemorrhoid*, fifth century. Coptic textile. London, Victoria and Albert Museum (inv. no. 722-1897).





Fig. 9. *Healings and Miracles of Christ*, early Byzantine amulet. London, British Museum (reg. no. 1938).

In his catalogue of early Christian gems, Jeffrey Spier shows a rock crystal with a representation of the Haemorrhoida at Christ's feet [Fig. 10].<sup>37</sup> Christ does not touch the woman, but his hand hovers protectively over her head. In his article "Medieval Byzantine Magical Amulets and Their Tradition", the author publishes two remarkable amulets. The intaglio hanger in silver of the New York Metropolitan Museum is a five centimetre high haematite with the Haemorrhoida at Christ's feet on one side, and Mary as orant on the other side [Fig. 11]. The inscriptions, corrupted as they are, refer to the passage in Mark.<sup>38</sup> Haematite is also called bloodstone and, because of its physical qualities, is connected to the healing of blood illnesses.<sup>39</sup>

An amulet in a private collection in Asia Minor combines a representation of the Haemorrhoida – the inscription reading *EMOROYC* – on one side, with a head with seven snakes on the other side [Fig. 12].<sup>40</sup> The snake-head is the gorgon, and connects the Haemorrhoida to the *hysteria* motif in the amulets.<sup>41</sup> Medusa's snake-head is nothing more than one of the many guises of the womb.<sup>42</sup> According to Spier, the amulets with the gorgon are not to be seen as a threat to the womb, but rather as its portrait. The portrait dispels and exorcises, as using the name of a demon exorcises him or her.

On amulets intended to exorcise the womb, one often finds the short inscription *Hysteriikon phylaktirion*.<sup>43</sup> Many inscriptions derive from a lengthier early Byzantine charm for the womb: 'Womb, Black. Blackening, as a snake you coil, and as a serpent you hiss, and as a lion you roar,

<sup>37</sup> Spier, *Late antique* cat. no. 684 a and b.

<sup>38</sup> Frazer M. – Weitzman K. (eds.), *The Age of Spirituality* (New York: 1977) 440; Spier, "Amulets" 44, fig. 6b; also shown by Kötzsche L., catalogue note in Weitzmann K. (ed.), *Age of Spirituality. Late Antique and Early Christian Art, Third to Seventh Century* (Princeton: 1979) 440 and Nauerth C.L., "Heilungswunder in der frühchristlichen Kunst", in Beck H. (ed.), *Spätantike und frühes Christentum* (Frankfurt am Main: 1983) 339–346, cat. no. 165. In n. 111, 44, Spier also refers to the Benaki Museum in Athens, which holds a mid-Byzantine green chalcidony intaglio bearing the Haemorrhoida and the Crucifixion, without inscription. Haematite is an iron ore that is not particularly rare. Characteristic for this stone is its red core, but once processed (sharpened or polished), it turns black to silvery.

<sup>39</sup> Meier C., *Gemma Spiritualis. Methode und Gebrauch der Edelsteinallegorese vom frühen Christentum bis ins 18. Jahrhundert* (Munich: 1977) 392–395.

<sup>40</sup> Spier, "Amulets" 28, 30, 44, 56; 44 "The bronze token with the Haemorrhoida suggests that it had to help women in some way".

<sup>41</sup> Veith I., *Hysteria. The History of a Disease* (Chicago: 1965).

<sup>42</sup> Pointon M., "Interior Portraits: Women, Physiology and the Male Artist", *Feminist Review* 22 (1986) 5–22.

<sup>43</sup> Spier, "Amulets" as in the silver ring in fig. 40–4d, and also on a leaden amulet, both Corinthian.

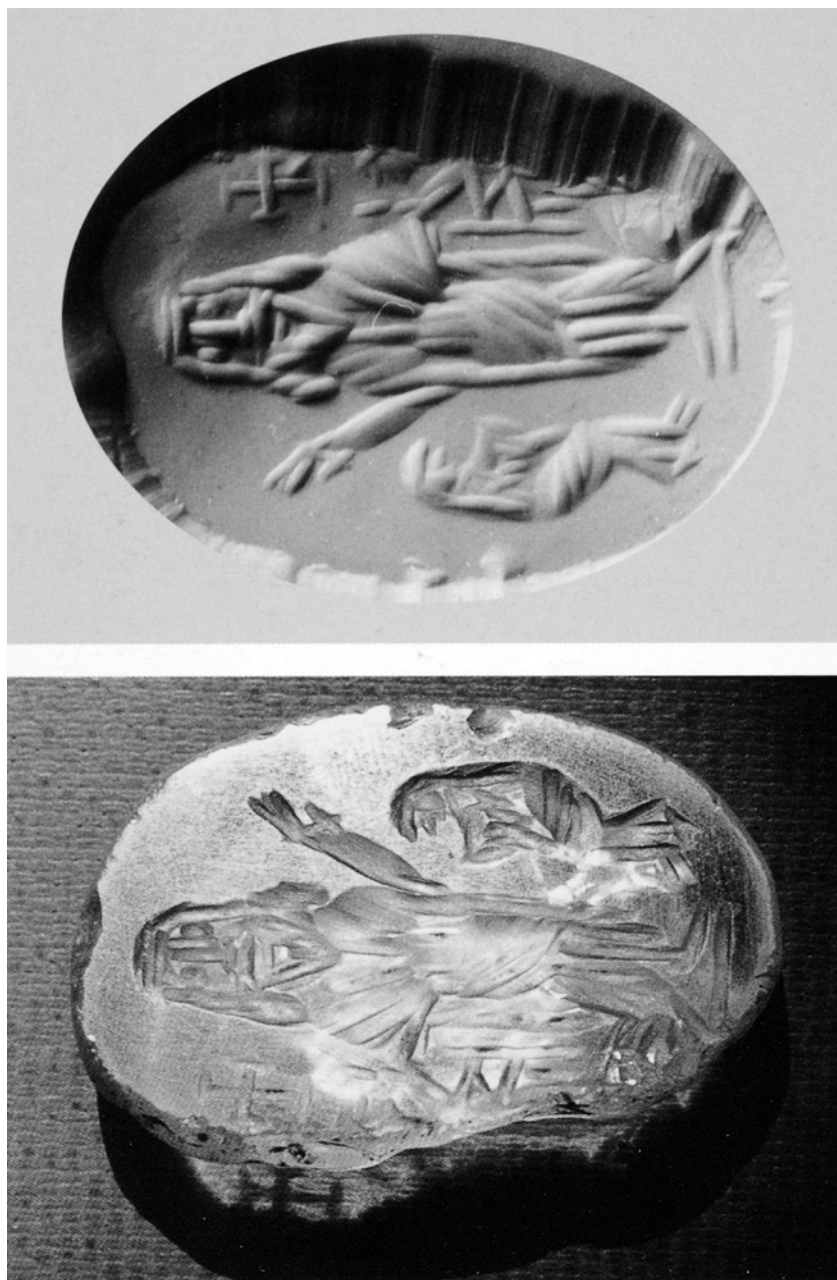


Fig. 10. *Healing of the Haemorrhoida*, crystal amulet. Rock crystal,  $30 \times 20 \times 4$  cm. New York, America Numismatic Society (inv. no. 307).



Fig. 11. *Healing of the Haemorrhoid and Mary in Orant*, haematite amulet. Egypt, late Antiquity. New York, Metropolitan Museum of Art (17.190.491).





Fig. 12. *Healing of the Haemorrhoids and hysteria motif, amulet. Private collection.*

and as a lamb, lie down'.<sup>44</sup> The charm asks the uterus to calm down, to shrink.<sup>45</sup> A sixth-century Coptic papyrus offers an example to control *hysteria*: 'Make the womb of so-and-so, who bore so-and-so, relax into the natural position, and be uninflamed'.<sup>46</sup> Another formula is: 'Set the womb of so-and-so in its proper place, you who lift up the disk of the sun'.<sup>47</sup> The charms were used for a wide range of uterine problems: birth, contraception, afterbirth, contractions, severe menstrual bleeding, etc.<sup>48</sup>

The amulets should be seen in the context of the conviction that the uterus is an animated creature, a demon, an animal that constantly needs to be calmed down.<sup>49</sup> The bronze amulet in the British Museum (fifth to sixth century) asks: 'Why do you munch like a wolf; why do you devour like a crocodile, why do you bite like a lion, why do you gore like a bull, why do you coil like a serpent, why do you lie down like a tame creature?'<sup>50</sup> In many cases the formulae are accompanied by 'Eat and drink blood!',<sup>51</sup> as the stopping of the bleeding was in many cases absolutely necessary, for instance for the unborn child during pregnancy. The exorcism was meant to make the *demon-hysteria* 'devour' the blood.<sup>52</sup> This is not surprising, as

<sup>44</sup> Spier, "Amulets" 30.

<sup>45</sup> Spier, "Amulets" 43, often this portrait is of an octopoid.

<sup>46</sup> Spier, "Amulets" 43.

<sup>47</sup> Spier, "Amulets" 43.

<sup>48</sup> There is much literature available on the uterus and menstruation in the premedical world; Cayleff S.E., "She Was Rendered Incapacitated by Menstrual Difficulties: Historical Perspectives on Perceived Intellectual and Physiological Impairment Among Menstruating Women", in Dan A.J. – Lewis L.L. (eds.), *Menstrual Health in Women's Lives* (Urbana, IL: 1992) 229–235; Dean-Jones L., "Menstrual Bleeding According to the Hippocratics and Aristotle", *Transactions of the American Philological Association* 119 (1989) 177–192; Green M., "Female Sexuality in the Medieval West", *Trends in History* 4, 4 (1990) 127–158; Hanson A.E., "Hippocrates: Diseases of Women I", *Signs* 1, 2 (1975) 567–584. Horowitz M.C., "Aristotle and Woman", *Journal of the History of Biology* 9, 2 (1976) 183–213, reveals Aristotle's biological and political sexism. For another viewpoint, see Morsink J., "Was Aristotle's Biology Sexist?", *Journal of the History of Biology* 12, 1 (1979) 83–112. See also Jacquart D. – Thomasset C. – Adamson M., *Sexuality and Medicine in the Middle Ages* (Princeton: 1988); Delancy J. – Lupton M.J. – Toth E., *The Curse. A Cultural History of Menstruation* (New York: 1976); Formanek, *The Meanings of Menopause*.

<sup>49</sup> According to Barb, "Three Elusive Amulets" fig. 6a, these ideas go back to Mesopotamian archetypes. The amulets also protect men infected by a 'womb', like the one (fig. 6a) for the Russian Basileos. Also see: Aubert J.-J., "Threatened Wombs: Aspects of Ancient Uterine Magic", *Greek, Roman and Byzantine Studies* 30 (1989) 421–449; Bodemer C.W., "Historical Interpretations of the Human Uterus and Cervix Uteri", in Blandau R.J. – Moghissi K. (eds.), *The Biology of the Cervix* (Chicago: 1983) 1–11; Griffin S., *Woman and Nature. The Roaring Inside Her* (New York: 1978).

<sup>50</sup> Spier, "Amulets" 45.

<sup>51</sup> Spier, "Amulets" 46.

<sup>52</sup> Other examples in Ritner, "A Uterine Amulet in the Oriental Institute Collection" *passim*.

the uterus can swell to dangerous proportions; it can hold or expel great quantities of blood. Many charms refer to haematite as 'bloodstone' or 'fossilised blood'.<sup>53</sup> Also in terms of etymology haematite – *haima-tithenai* – refers to 'blood that stops'.<sup>54</sup> The history of haematite as a form of 'mineral blood' goes back a long way. The fourth-century *Orphica*, a poem about the magical qualities of stones which dates back to a very early period of Asian literature, calls haematite Chronos' blood that dripped down from the sky and was preserved in stone. The author starts his verses about the haematite with 'A leech came down from heaven'.<sup>55</sup>

Early Byzantine and also Germanic charms evoking Zechariah usually go as follows: 'By the great name of the almighty God. The prophet Zacharias was slaughtered in the temple to the Lord and his blood solidified in the middle of the sanctuary like a Stone. So thou too stop the blood of the servant of God, congeal disease, as that one and as a Stone, may it be annulled. I exorcise thee by the Faith of Veronica (*Beraioonikii*), blood, that you may not drip further; let us stay good, let us stay in fear; amen. Jesus Christ conquers'.<sup>56</sup> Following this, believers were to rub some of their own blood on their forehead, for instance with a stalk of straw. It is worth noting that Veronica/Berenice is mentioned in the proverb; her own connection with blood dates not from the miraculous portrait but from the apocryphal legend that identified her with the woman with the bloody issue.<sup>57</sup> *Beraioonikii* is the name given to the Haemorrhissa from the third-century apocrypha onwards.<sup>58</sup>

<sup>53</sup> Barb A.A., "St. Zacharias the Prophet and Martyr: A Study in Charms and Incantations", *Journal of the Warburg and Courtauld Institutes* 11 (1948) 35–67, 63 and 67.

<sup>54</sup> Meier, *Gemma Spiritualis* 394 'Hematites [...] dicitur ab hema, quod est sanguis, et tithein, quod est sistere, quasi sistens sanguinem' after Petrus Berchorius (ca. 1290–1362), *Reductorium morale* XI, 440a. In the same passage Berchorius attributes the haemorrhage to 'luxuria', to 'carnalis voluptas, mundana prosperitas, fluxusque cujusunque iniquitatis' and thereby refers to the passage in *Mark*. 'Figura de haemorrhissa, quae ad tactum vestimenti Christi a fluxu sanguinis est sanata. Vestimentum Christi est abstinencia, quae re vera sanat ab istis fluxibus animam peccatricem'. The connection between illness and sin, at least in the late Middle Ages, requires further research.

<sup>55</sup> Abel, *Orphica*, verse 642; Barb, "St. Zacharias" 67.

<sup>56</sup> Ebermann O., *Blut- und Wundsegen in ihrer Entwicklung dargestellt* (Berlin: 1903); Barb, "St. Zacharias" 38–42.

<sup>57</sup> Kusters L., "Who is She? The Identity of the Haemorrhaging Woman and her *Wirkungsgeschichte*", *Antwerp Royal Museum Annual* (2009) 99–133; Dobschütz E. von, *Christusbilder. Untersuchungen zur christlichen Legenden* (Leipzig: 1899) 250.

<sup>58</sup> Barb, "St. Zacharias" 42; James M.R., *The Apocryphal New Testament* (Oxford: 1924) 102; Bernice; 183; Beronice; 306; Berenice; and 157: Veronica. The name would also become an exorcism for various problems. It is also used for fine nitrate.



Exorcism took place in 'Berenice's faith', referring to the final verses of the synoptic account in which her faith made her well again. The Haemorrhoea's power is double – taking power away from Christ, but also her own powerful faith. It combines the realm of superstition and magic with that of orthodoxy. At that intersection, the Haemorrhoea character found the mixed composition that is typical for charms and exorcisms. A medieval Latin example goes as follows: 'For stopping blood from the nose. In the name of Christ write on the forehead with the own blood of the same the name of Veronica. The same is it who said: If I touch the fringe of the garment of my Lord I shall be healed'.<sup>59</sup> The same reference can be found in a formula in a thirteenth-century Greek pharmaceutical manual by Nicolaus Myrepsus. The author copies the passage in *Matthew* verbatim.<sup>60</sup>

In the earlier part of this article, we have already indicated the early Christian interpretation of the Haemorrhoea passage in the context of the Jewish and antique taboo of the menstruating woman. While we have identified a lacuna in the iconographic visualisation of the issue of blood, we see its connotations 'visibly' appear in the world of gems and amulets. They reveal that the woman was gradually charged with the fears and fascinations of the 'wild uterus' and its bleeding. In sum, the Haemorrhoea performatively became engaged in magical healing practices related to haemorrhages, in exorcism and conjuration.

### Conclusion

The iconography of the healing of the Haemorrhoea relates to the story of the synoptic Gospels by isolating or compressing different moments, with other elements of the story being visually ignored. More specifically, the iconography demonstrates a lacuna in the depiction of the issue of blood, clearly identified in recent exegesis as uterine bleeding (the *fons*

<sup>59</sup> 'Ad sanguinem de naribus sistendum. In Christi nomine in fronte scribis de ipso sanguine ipsius nomen Beronicae, ipsa est quae dixit: se tetigero fimbriam vestimenti domini mei salvo ero'. Barb, "St. Zacharias" 43, note 1; Steinmeyer E. von, *Die kleineren althoch-deutschen Sprachdenkmäler* (Berlin: 1916) 392.

<sup>60</sup> Nicolae Myrepsi Alexandrini, *De compositione medicamentorum opus [...] a Leonharto Fuchsio [...] e Graeco in Latinum conversum [...]* in Estienne H., *Medicae artis principes post Hippocratem et Galenum Graeci Latinitate donati* (Paris: 1567); Barb, "St. Zacharias" 43; Meyer E., *Geschichte der Botanik III* (Königsberg: 1856) 339–390; Allbutt T.C., *Greek Medicine in Rome* (London: 1921) 439.

*sanguinis*'). But the issue of blood does not completely recede into the background: by means of typological combinations there is an oblique suggestion of the 'issue of blood' as a *fons*, a wellspring, echoing how the womb of the *zabâ* was conceptualised in *Leviticus*.

In the early medieval reception of the story, however, a profound connection to uterine and menstrual issues again resurfaces. The Haemorrhoid's miracle of healing becomes entangled in the world of magical healing, and settles itself in the *hysteria* field. At the level of sarcophagi it is not possible to notice this, but the Haemorrhoid's *hysteria* does appear in late-antique and early-Byzantine exorcism charms, intaglios, and protective amulets. This reveals an ongoing interaction between the textual miracle and magical practices. The Haemorrhoid is lifted outside the gospel to lead a life of her own as a protector for women against bleeding from the uterus, and for men against dangerous swellings.

When we reconstruct the Haemorrhoid's story in its textual and iconographical *Nachleben*, it quickly becomes a story of blood. Her 'issue of blood' takes on a range of different semantic layers, most obvious in the ways in which its diverse constructions reflect the transition of Jewish impurity laws to the Christian teachings of healing. These bring the Haemorrhoid to the world of magical healing: exorcising blood with blood.

### Selective bibliography

- ALLBUTT T.C., *Greek Medicine in Rome* (London: 1921).
- AMT E. (ed.), *Women's Lives in Medieval Europe. A Sourcebook* (New York: 1993).
- ASTERIUS OF AMASIA, *Homily 1*: ed. Migne J.P. (1858), *SS. Patrum Aegyptiorum Opera omnia*, *Patrologia Graeca* 40, Paris, cols. 163–180.
- AUBERT J.-J., "Threatened Wombs: Aspects of Ancient Uterine Magic", *Greek, Roman and Byzantine Studies* 30 (1989) 421–449.
- BAERT B., "La Piscine Probatoire à Jérusalem: L'eau médicinale au Moyen Âge", in Cardon B. (ed.), *"Als Ich Can". Liber Amicorum in Memory of Professor Dr. Maurits Smeyers* (Leuven: 2002) 91–129.
- , "The Healing of the Blind Man at Siloam, Jerusalem: A Contribution to the Relationship between Holy Places and the Visual Arts in the Middle Ages", *Arte Cristiana* 838 (2007) 49–60; 839 (2007) 121–130.
- , "The Pool of Bethesda: The Cultural History of a Holy Place in Jerusalem", *Viator. Medieval and Renaissance Studies* 36 (2005) 1–22.
- BAERT B. – KUSTERS L., "The Twilight Zone of the Noli me tangere: Contributions to the History of the Motif (ca. 400–ca. 1000) in the West", *Louvain Studies* 32 (2007) 255–308.
- BARB A.A., "St. Zacharias the Prophet and Martyr: A Study in Charms and Incantations", *Journal of the Warburg and Courtauld Institutes* 11 (1948) 35–67.
- , "Three Elusive Amulets", *Journal of the Warburg and Courtauld Institutes* 27 (1964) 1–22.
- BODEMER C.W., "Historical Interpretations of the Human Uterus and Cervix Uteri", in Blandau R.J. – Moghissi K. (eds.), *The Biology of the Cervix* (Chicago: 1983) 1–11.
- BRANHAM J.R., "Blood and Sanctity at Issue", *Res. Anthropology and Aesthetics* 31 (1997) 53–70.
- , "Bloody Women and Bloody Spaces", *Harvard Divinity Bulletin* (e-journal) 30/06/04.
- , "Frauen und blutige Räume: Menstruation und Eucharistie in Spätantike und Mittelalter", *Vorträge Warburg-Haus* 3 (1999) 129–161.
- , "Penetrating the Sacred: Breaches and Barriers in the Jerusalem Temple", in Gerstel S. (ed.), *Thresholds of the Sacred. Architectural, Art Historical, Liturgical and Theological Perspectives on Religious Screens, East and West* (Cambridge: 2006) 6–24.
- , "Sacred Space under Erasure in Ancient Synagogues and Early Churches", *Art Bulletin* 74, 3 (1992) 375–394.
- BRUYNE L. DE, *L'imposition des mains dans l'art chrétien ancien* (Vatican 1943).
- CAYLEFF S.E., "She Was Rendered Incapacitated by Menstrual Difficulties: Historical Perspectives on Perceived Intellectual and Physiological Impairment Among Menstruating Women", in Dan A.J. – Lewis L.L. (eds.), *Menstrual Health in Women's Lives* (Urbana, IL: 1992) 229–235.
- COHEN S., "Menstruants and the Sacred in Judaism and Christianity", in Pomeroy S.B. (ed.), *Women's History and Ancient History* (Chapel Hill, NC: 1991) 271–299.
- CONNOLLY R.H., *Didascalia Apostolorum* (Oxford: 1929).
- D'ANGELO M.R., "Gender and Power in the Gospel of Mark: The Daughter of Jairus and the Woman with the Flow of Blood", in Cavadini J.C. (ed.), *Miracles in Jewish and Christian Antiquity. Imagining Truth*, *Notre Dame Studies in Theology* 3 (Notre Dame: 1999) 83–109.
- DEAN-JONES L., "Menstrual Bleeding According to the Hippocratics and Aristotle", *Transactions of the American Philological Association* 119 (1989) 177–192.
- DECKERS J.G. – SEELIGER H.R. – MIETKE G., *Die Katacombe "Santi Marcellino e Pietro". Repertorium der Malereien* (Vatican-Münster: 1987) 223–226, 241–243, 309–318, 330–334.
- DELANCY J. – LUPTON M.J. – TOTH E., *The Curse. A Cultural History of Menstruation* (New York: 1976).

- DIONYSIUS OF ALEXANDRIA, *Epistola canonica ad Basilidem episcopum, Canon II*: ed. Migne J.P. (1857), *S.P.N. Gregorii, Cognomento Thaumaturgi, Opera quae reperi potuerunt omnia*, Patrologia Graeca 10, Paris, cols. 1281–1284.
- DOBSCHÜTZ E. VON, *Christusbilder. Untersuchungen zur christlichen Legenden* (Leipzig: 1899).
- EBERMANN O., *Blut- und Wundsegen in ihrer Entwicklung dargestellt*, Palaestra 24 (Berlin: 1903).
- ESTIENNE H., *Medicae artis principes post Hippocratem et Galenum Graeci Latinitate donati* (Paris: 1567).
- FONROBERT C., *Menstrual Purity. Rabbinic and Christian Reconstructions of Biblical Gender* (Stanford: 2000).
- , “The Woman with a Blood-Flow (Mark 5:24–34) Revisited: Menstrual Laws and Jewish Culture in Christian Feminist Hermeneutics”, in Evans C.A. – Sanders J.A. (eds.), *Early Christian Interpretation of the Scriptures of Israel. Investigations and Proposals*, JSNTS 148 – Studies in Scripture in Early Judaism and Christianity 5 (Sheffield: 1997) 121–140.
- FORMANEK R. (ed.), *The Meanings of Menopause. Historical, Medical and Clinical Perspective* (Hillsdale: 1990).
- FRAZER M. – WEITZMAN K. (eds.), *The Age of Spirituality* (New York: 1977).
- GREEN M., “Female Sexuality in the Medieval West”, *Trends in History* 4, 4 (1990) 127–158.
- GREGORY THE GREAT, *Epistola* 64: ed. Migne J.P. (1849), *Sancti Gregorii Papae I Cognomento Magni, Opera omnia*, Patrologia Latina 77, Paris, cols. 1183–1199.
- GRIFFIN S., *Woman and Nature. The Roaring Inside Her* (New York: 1978).
- GRUENWALD I., *Apocalyptic and Merkavah Mysticism*, Arbeiten zur Geschichte des antiken Judentums und des Urchristentums 14 (Leiden: 1980).
- HABER S., “A Woman’s Touch: Feminist Encounters with the Hemorrhaging Woman in Mark 5:24–34”, *Journal for the Study of the New Testament* 26, 2 (2003) 171–192.
- HANSON A.E., “Hippocrates: Diseases of Women I”, *Signs* 1, 2 (1975) 567–584.
- HOROWITZ M.C., “Aristotle and Woman”, *Journal of the History of Biology* 9, 2 (1976) 183–213.
- HORSLEY R.A., *Hearing the Whole Story. The Politics of Plot in Mark’s Gospel* (Louisville: 2001).
- JACQUART D. – THOMASSET C. – ADAMSON M., *Sexuality and Medicine in the Middle Ages* (Princeton: 1988).
- JAMES M.R., *The Apocryphal New Testament* (Oxford: 1924).
- JONAS OF ORLÉANS, *De institutione laicali*: ed. Migne J.P., Patrologia Latina 187–188 (Paris: 1851) col. 106.
- KNIPP D., ‘Christus Medicus’ in der frühchristlichen Sarkophagskulptur. *Ikongraphische Studien der Sepulkalkunst des späten vierten Jahrhunderts* (Leiden: 1998).
- KÖTZSCHE L., catalogue note in Weitzmann K. (ed.), *Age of Spirituality. Late Antique and Early Christian Art, Third to Seventh Century* (Princeton: 1979) 440.
- KUSTERS L., “Who is She? On the Identity of the Haemorrhaging Woman and her Wirkungsgeschichte”, *Antwerp Royal Museum Annual* (2009) 99–133.
- LEMARQUAND G., *An Issue of Relevance. A Comparative Study of the Story of the Bleeding Woman (Mk 5:25–34; Mt 9:20–22; Lk 8:43–48) in North Atlantic and African Contexts* (New York: 2004).
- LEVINE A.-J., “Discharging Responsibility: Matthean Jesus, Biblical Law and Hemorrhaging Woman”, in Bauer D.R. – Powell M.A. (eds.), *Treasure New and Old. Recent Contributions to Matthean Studies* (Atlanta: 1996) 379–397.
- LOOS H. VAN DER, *The Miracles of Jesus* (Leiden: 1965) 509–510.
- MANGO C., *The Art of the Byzantine Empire 312–1453. Sources and Documents* (Englewood Cliffs: 1972).
- MARCUS J., *Mark 1–8. A New Translation with Introduction and Commentary* (New York: 2000).

- MATHEWS T.F., *The Clash of Gods. A Reinterpretation of Early Christian Art* (New Jersey: 1993) 65–66.
- MCCRACKEN P., *The Curse of Eve, The Wound of the Hero. Blood, Gender and Medieval Literature*, The Middle Ages Series (Philadelphia, PA: 2003).
- MCNEILL J. – GAMER H.M., *Medieval Handbooks of Penance. A Translation of the Principal Libri Poenitentialis and Selections from Related Documents* (New York: 1990).
- MEIER C., *Gemma Spiritualis. Methode und Gebrauch der Edelsteinallegorese vom frühen Christentum bis ins 18. Jahrhundert* (Munich: 1977).
- MEYER E., *Geschichte der Botanik III* (Königsberg: 1856).
- MORSINK J., “Was Aristotle’s Biology Sexist?”, *Journal of the History of Biology* 12, 1 (1979) 83–112.
- NAUERTH C.L., “Heilungswunder in der frühchristlichen Kunst”, in Beck H. (ed.), *Spätantike und frühes Christentum*, (Frankfurt am Main: 1983) 339–346, cat. no. 165.
- NOGA-BANAI G., *The Trophies of the Martyrs. An Art Historical Study of Early Christian Silver Reliquaries* (Oxford: 2008).
- OPPEL D., *Heilsam erzählen – erzählend heilen. Die Heilung der Blutflüssigen und die Erweckung der Jairustochter in Mk 5,21–43 als Beispiel markinischer Erzählfertigkeit*, Bonner biblische Beiträge 12 (Weinheim: 1995).
- ORIGEN, *Contra Celsum*: tr. Chadwick H. (Cambridge: 1965).
- PAYER P.J., *Sex and the Penitentials. The Development of a Sexual Code 550–1150* (Toronto: 1984).
- PLASKOW J., “Antijudaism in feminist Christian Interpretation”, in Schüssler Fiorenza E. (ed.), *Searching the Scriptures. A Feminist Introduction* (New York: 1993) 117–129.
- POINTON M., “Interior Portraits: Women, Physiology and the Male Artist”, *Feminist Review* 22 (1986) 5–22.
- RITNER R.K., “A Uterine Amulet in the Oriental Institute Collection”, *Journal of Near Eastern Studies* 43, 3 (1984) 209–221.
- ROBERTSON A.T. – PERSCHBACHER W.J., *Word Pictures of the New Testament*, 1, *Matthew and Mark* (Grand Rapids: 2004).
- RONIG F.J., “Erläuterungen zu den Miniaturen des Egbert Codex”, in Dornheim S.D. (ed.), *Der Egbert Codex. Das Leben Jesu. Ein Höhepunkt der Buchmalerei vor 1000 Jahren* (Stuttgart: 2005) 122–124.
- SCHIEL H., *Codex Egberti der Stadtbibliothek Trier* (Basel: 1960).
- SCHILLER G., *Iconography of Christian Art*, 1. *Christ’s Incarnation, Childhood, Baptism, Temptation, Transfiguration, Works and Miracles* (London: 1971).
- SCHOLEM G.G., *Jewish Gnosticism, Merkabah Mysticism and Talmudic Tradition* (New York: 1960).
- SCHÜSSLER FIORENZA E., *In Memory of Her. A Feminist Theological Reconstruction of Christian Origins* (New York: 1994).
- SELVIDGE M.J., “Mark 5:25–34 and Leviticus: A Reaction to Restrictive Purity Regulations”, *Journal of Biblical Literature* 104, 4 (1984) 619–623.
- , *Woman, Cult, and Miracle Recital. A Redactional Critical Investigation on Mark 5: 24–34* (London: 1990).
- SPIER J., *Late Antique and Early Christian Gems* (Wiesbaden: 2007).
- , “Medieval Byzantine Magical Amulets and Their Tradition”, *Journal of the Warburg and Courtauld Institutes* 56 (1993) 25–62.
- STEINMEYER E. VON, *Die kleineren althochdeutschen Sprachdenkmäler* (Berlin: 1916).
- STRUTHERS MALBON E., “Narrative Criticism: How Does the Story Mean?”, in Anderson J.C. – Moore S.D. (eds.), *Mark and Method. New Approaches in Biblical Studies* (Minneapolis: 1992) 23–49.
- TRUMMER P., *Die Blutende Frau. Wunderheilung im Neuen Testament* (Freiburg: 1991).
- VEITH I., *Hysteria. The History of a Disease* (Chicago: 1965).
- WOOD C.T., “The Doctor’s Dilemma: Sin, Salvation, and the Menstrual Cycle in Medieval Thought”, *Speculum* 56, 4 (1981) 710–727.

THE NATURE OF THE SOUL AND THE PASSAGE OF BLOOD  
THROUGH THE LUNGS. GALEN, IBN AL-NAFĪS, SERVETUS,  
İTAKİ, ‘AṬṬĀR

Rainer Brömer

*Summary*

Since Muḥyī el-Dīn el-Taṭāwī's supposed rediscovery, in 1924, of Ibn al-Nafīs' thirteenth-century commentary on Avicenna's anatomy, a heated international debate has evolved over the presumed priority of discovering the circulation of the blood, prior to William Harvey's *De motu cordis* (1628). Protagonists of this dispute before Fancy (2006) have paid very little attention to the profoundly different physiological and epistemological frameworks the historical actors were working in, despite striking similarities in some anatomical details of their respective concepts. While actual links between the European successors of Ibn al-Nafīs, such as Miguel Servet(o) (Michael Servetus) or Realdo Colombo (Realduus Columbus) remain speculative, it is becoming increasingly clear that, in the Islamic world, the work of the former was by no means lost: it continued to be cited in Arabic and Turkish sources well into the nineteenth century by authors such as Şemsettin İtākī (1632) and Ḥasan al-‘Aṭṭār (1813).

*Introduction*

Our knowledge of the history of medicine in Islamic civilisations is still lamentably limited. Even the most influential classical texts, such as Haly Abbas' *Kāmil al-Şinā'a* (late tenth century), still await comprehensive critical editions, let alone reliable translations into Western languages, which would make these writings available to a wider readership of historians not specialising in Middle Eastern philology.<sup>1</sup> We should therefore not be surprised to find statements to the effect that certain singular empirical or conceptual innovations did not produce any echo in the subsequent

---

<sup>1</sup> The anatomical section is available in an edition with French translation in Koning P. de (tr.), *Trois traités d'anatomie arabes par Muḥammed ibn Zakariyyā al-Rāzī, 'Alī ibn al-Abbās et 'Alī ibn Sīnā* (Leiden: 1903) 91–431. The Latin recension by Constantine the African under the title *Liber Pantegni yssac israelite filii adoptivi Salomonis regis arabie* is available electronically in a print version dating from 1515, not in a scholarly edition.

literature – an assessment perhaps based on the fact that later, ‘minor’ texts have escaped the attention of historians of medicine? This observation should caution us against taking those claims at face value. A good example of such oversight is the case of Ibn al-Nafīs’ description of the pulmonary transit of the blood, which is the main subject of this chapter. Ibn al-Nafīs’ text was brought to the attention of modern western readers in the 1930s thanks to a dissertation by an Egyptian medical student in Berlin and Freiburg, Muḥyī el-Dīn el-Taṭāwī (1896–1935),<sup>2</sup> and as late as 2008, two leading Turkish historians of medicine claimed that ‘in the Muslim world, there was no physician who became aware of this discovery; they did not utter a word about it’.<sup>3</sup> Almost twenty years earlier, economic historian Peter Gran had published an extensive study on a well-known nineteenth-century scholar from Egypt, Ḥasan al-‘Aṭṭār (1766–1835), where indeed we find a lengthy quotation from Ibn al-Nafīs’ description of the pulmonary passage in a text written in Damascus around 1813.<sup>4</sup> It needs to be said, however, that this quotation had been taken out of its medical context and found itself buried in a book on the socio-economic history of early modern Egypt, where it, too, escaped the attention of medical historians.<sup>5</sup>

<sup>2</sup> Tatawi, M., *Der Lungenkreislauf nach el-Koraschi*. Diss. med. (Freiburg: 1924). This work, together with a number of contributions to the debate it triggered, has been reprinted in Sezgin F. (ed.), *‘Ali ibn abi l-Ḥazm al-Qarshi Ibn al-Nafīs (d. 687/1288). Texts and Studies* (Frankfurt: 1997) 1–25. While Tatawi subsequently pursued a clinical career and died in 1935, at the age of 38, his Egyptian colleague of German origin, Max Meyerhof, made his work known through a series of articles in international academic journals. The earliest report is Meyerhof M., “El-Tatawi, Mohyi el-Din: Der Lungenkreislauf nach el-Koraschi”. *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften* 30 (1931) 55–57. He subsequently edited and translated the relevant passages in Meyerhof M., “Ibn an-Nafīs und seine Theorie des Lungenkreislaufs”, *Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin* 4 (1933) 37–88 [7+15 pp. Arabic text].

<sup>3</sup> Kâhya E. – Demirhan Erdemir A., *Medical Studies and Institutions in the Ottoman Empire (with brief information about the scientific studies)* (Ankara: 2008) 29. The particular irony of this remark will become apparent below, when we discuss a Turkish text from the seventeenth century dealing with Ibn al-Nafīs’ idea, written by the Ottoman court physician Şemsettin İtâki, who does indeed discuss these ideas at some length. This text was studied and edited by one of the authors of the above quotation, Esin Kahya. However, the quoted remark does not occur in the Turkish edition of their survey published on the occasion of the 700th anniversary of the Ottoman Empire, where they offer an otherwise almost identical presentation of Ibn al-Nafīs, *eadem, Osmanlıdan Cumhuriyete Tıp ve Sağlık Kurumları* (Ankara: 2000) 57–58.

<sup>4</sup> Gran P., *Islamic Roots of Capitalism. Egypt, 1760–1840* (Syracuse, NY: 1998) 170.

<sup>5</sup> On the history of this non-discovery, see, for instance, Brömer R., “Nutzen und Nutzung der islamischen Medizingeschichte”, in Fansa M. (ed.), *Ex oriente lux? Wege zur neuzeitlichen Wissenschaft* (Mainz: 2009) 202–211.



When we turn to Islamic anatomical texts from the Ottoman period, we find that the question of an exclusive passage of the blood through the lungs (as opposed to seeping through the central wall of the heart) was present, and even critical discussants would include a due attribution to Ibn al-Nafis. Do these observations prove right those colleagues who, for almost a century, have claimed that European Renaissance anatomists from Vesalius to Harvey had been inspired by the Syro-Egyptian physician when formulating the concept of a universal circulation of the blood through the entire body, thus usurping the Arab's fame as discoverer?<sup>6</sup> As we will see in the following sections of this chapter, it is on the one hand plausible that the Paduan school of human anatomy may have had some knowledge, direct or indirect, of Ibn al-Nafis' anatomical commentary. However, both the method and the motivation of the Egyptian and the Paduans differed fundamentally, as did the outcomes: nowhere does Ibn al-Nafis talk about circulation, for the simple reason that his model of blood flow is not circular. Nor, in all likelihood, is his work based on dissection, and almost certainly not on vivisection (as is Harvey's), while there is no hint of any quantitative approach to his considerations. Therefore, it does not seem appropriate to conceive of Ibn al-Nafis as an unacknowledged precursor of Harvey, and this conclusion would remain true even if it could be established that anatomists at Padua, Harvey's *alma mater*, had indeed possessed knowledge of the relevant Arabic sources. The non-discovery of the circulation of the blood prior to Harvey has been demonstrated beyond reasonable doubt by a large number of scholars.<sup>7</sup> The present chapter will therefore take this aspect for granted, and instead focus on the contextualisation and reception of Ibn al-Nafis' specific idea in the Islamic world and also on possible conceptual parallels in (or influences on?) Miguel Servet. Nevertheless, it needs to be remembered that there is a continuous stream of occidentalist literature claiming Muslim priority for the discovery of pulmonary (and, by implication: systemic) circulation, which academic historians of medicine cannot simply ignore.<sup>8</sup>

---

<sup>6</sup> For a recent representative example, see Ghazal S. (2002): "The Discovery of the Pulmonary Circulation: Who should get the Credit: Ibn Al-Nafis or William Harvey", *Journal of the International Society for the History of Islamic Medicine* 1 (2002) 46–48.

<sup>7</sup> For example, for Ibn al-Nafis, see Pormann P. – Savage-Smith E., *Medieval Islamic Medicine* (Edinburgh: 2007) 47–48.

<sup>8</sup> While the term Occidentalism can be traced back at least to Russian cultural debates in the early nineteenth century, it was the Egyptian philosopher Ḥasan Ḥanafī who developed this notion as a counter-concept in order to turn the tables on Western "Orientalism" *sensu* Edward Said, i.e., to reverse Western hegemony by studying its underlying culture

*Ibn al-Nafīs. Criticism of Galen and Avicenna*<sup>9</sup>

The thirteenth century was a period of turmoil and massive change in the Islamic world: the Arab succession to the Prophet of Islam effectively ended with the extinction of the Abbasid dynasty in Baghdad, the city itself being destroyed in 1258 by the army of the Mongol Khan Hülägü. The impact of these momentous events on the intellectual development of the Islamic world has been the subject of debate: while there is no doubt that the destruction of the famous library led to an enormous loss of scholarly texts, it also needs to be remembered that the same Hülägü Khan, only one year after the sack of Baghdad, commissioned the creation of what was at that time the largest astronomical observatory in Maragha, complete with a library and other facilities required for scientific pursuits, ushering in a new age of rapid scientific innovation.<sup>10</sup> Similarly, apocalyptic visions from the vantage point of the Egyptian Mamlūks (who brought the Mongol advance to a halt at the Syrian spring of 'Ayn Jālūt in 1260 and installed a kind of 'shadow caliphate' in Cairo) now increasingly seem to be constructions of the following centuries rather than a widespread sentiment of the time, even though there was some argument in the late thirteenth century about the invasion as divine punishment and a call for the return to the ways of the Prophet, including in the field of medicine.<sup>11</sup>

The Syrian physician Ibn al-Nafīs had been living in Cairo for over a decade by the time that the Mamlūks wrested power from the Ayyūbids in 1250. For most of his life, he worked at the Nāṣirī hospital, built by the

---

and philosophy; see Ḥanafī Ḥ., *Muqaddima fī 'ilm al-istighrāb (Prolegomena to the Discipline of Occidentalism)* (Cairo: 1991).

<sup>9</sup> It is my pleasure to acknowledge my debt for much of the content of this section to my colleague Nahyan Fancy. Both through his dissertation and through personal conversations he has helped me enormously in transcending the limitations of traditional historiography of medicine and considering the wider philosophical issues shaping the thought of classical Islamic scholars, Fancy N., *Pulmonary Transit and Bodily Resurrection. The Interaction of Medicine, Philosophy and Religion in the Works of Ibn al-Nafīs (d. 1288)* (Notre Dame: 2006). The responsibility for possible misappropriations and misinterpretations lies of course entirely with the present author.

<sup>10</sup> The subsequent developments have been analysed by Fazlıoğlu İ., (2008): "The Samarqand Mathematical-Astronomical School: A Basis for Ottoman Philosophy and Science", *Journal for the History of Arabic Science* 14 (2008) 3–68.

<sup>11</sup> On 'Prophetic Medicine' (or 'The Prophet's Medicine'), see, e.g., Attewell G., "Islamic Medicines: Perspectives on the Greek Legacy in the History of Islamic Medical Traditions in West Asia", in Selin H. – Shapiro H., *Medicine Across Cultures* (Dordrecht: 2003) 325–350, esp. 329–333. More extensively: Perho I., "The Prophet's Medicine: A Creation of the Muslim Traditionalist Scholars", *Studia Orientalia* 74 (1995) 1–158.

founder of the Ayyūbid dynasty, Ṣalāḥ al-Dīn (Saladin), and in the last few years of his career at the Manṣūrī hospital founded in 1284 by the Mamlūk Sultan Qalāwūn.<sup>12</sup> It is therefore appropriate to refer to Ibn al-Nafīs as a physician by profession, even though his erudition and literary production spanned the whole range of *‘ulūm* and *ādāb* (loosely: sciences, including the religious disciplines, and *belles lettres*), and he figures prominently in several near-contemporary biographical dictionaries of Shāfi‘ī religious jurists, while he is curiously absent from the leading medical biographical dictionary of his time written by Ibn Abī Uṣaybi‘a.<sup>13</sup> This clarification is significant for understanding the complexity of his writings, which should not be reduced to disciplinary works only (or even mainly) restricted to a single field of enquiry. Thus, when Ibn al-Nafīs criticises established medical authorities such as Galen and Avicenna, as we will see in the following paragraphs, we have to consider his philosophical and religious commitments as well as the medical aspects of his work, and we should not be surprised to find that the physiology of the soul, from a primarily theological viewpoint, may well take precedence over anatomical empiricism regarding the structure and function of the heart, lungs, and the connecting major blood vessels.

This is not to say that Ibn al-Nafīs had been generally averse to the empirical practice of anatomy, although it is not always easy to understand what aspect of *tashrīḥ* the author refers to, given that the Arabic term is ambiguous, meaning anatomical knowledge as well as dissection.<sup>14</sup> There are passages in Ibn al-Nafīs’s writings where he unequivocally talks about the ‘practice of dissection (*mubāsharat al-tashrīḥ*)’, but mainly in a negative sense, where the physician declares that he had been discouraged by ‘the precepts of Islamic law [...] along with whatever compassion is in our temperaments’; at the same time, he admits that certain

<sup>12</sup> For a very brief sketch of Cairo’s hospital history from the Ayyūbids to the Mamlūks, see Pormann – Savage-Smith, *Medieval Islamic Medicine* 99–100. A detailed treatment with a focus on Qalāwūn’s Manṣūrī hospital can be found in Issa Bey A., *Histoire des Bimaristans (hopitaux) à l’époque islamique* (Cairo: 1928) 40–76.

<sup>13</sup> In general, surprisingly little is known about Ibn al-Nafīs’ life; see Fancy N., *Pulmonary Transit*, esp. 44–48. There are a number of biographies available in Arabic, though they are based on a limited range of sources. For a relevant recent contribution see Zaydan Y., *‘Alā’ al-Dīn (Ibn al-Nafīs) al-Qarashī – i‘ādat iktishāf* (Abu Dhabi: 1999).

<sup>14</sup> In the Latin West, it was only around the same time (turn of the fourteenth century) that “The term “anatomy” acquired the sense of the exercise consisting of the dissection of an individual human body according to prescribed rules’, while previously the mandatory “[...] anatomy of human bodies” [...] would be fulfilled through the study of texts and dissection of animals’. Siraisi N., *Medieval & Early Renaissance Medicine* (Chicago: 1990) 86.

studies would even require vivisection, yet that approach he regards as impractical because of the ‘disturbance of the living (*idṭirāb al-ḥayy*) due to its feeling of pain’ – not, it seems, because of any ethical concerns.<sup>15</sup> However, as the context of these quotations makes clear, the author does not lay claim to any empirical or even experimental innovations over his ancient and more recent ancestors – even though he refers to anatomy (*tashrīḥ*) as disproving Avicenna’s description of the connections between the two main ventricles of the heart.<sup>16</sup> More specifically, at a time when many scholars advocate a return to scriptural and traditional sources against the pursuit of rational philosophy (*falsafa*), including the field of medicine, Ibn al-Nafis seeks to achieve a fine balance between reason and revelation. It is in this context, as Nahyan Fancy has compellingly demonstrated, that he undertakes his thorough investigation of philosophical implications from anatomical detail as found in the works of Galen and Avicenna: (medical) physiology for Ibn al-Nafis is of crucial importance to his arguments for a novel (theological) psychology, a ‘hylomorphic’ doctrine of the soul and its link with the (entire) body in view of bodily resurrection for the afterlife, reconciling philosophical reason and religious revelation, in opposition to the contention that reason alone could discover all religious truths without the intervention of prophecy.<sup>17</sup>

The nature of the soul had been a major issue in the different branches of Islamic thought before and after Avicenna, despite a Qur’ānic verse that could be understood as discouraging these speculations.<sup>18</sup> Galen’s concept of a tripartite soul had already been rejected in the Arab world by early

<sup>15</sup> The English translation can be found in Savage-Smith E., “Attitudes Toward Dissection in Medieval Islam”, *Journal of the History of Medicine* 50 (1995) 100–101. In S. Qaṭāya (Catahier) and B. Ghalyūnǧi’s edition of Ibn al-Nafis, ‘A., *Kitāb Sharḥ tashrīḥ al-Qānūn* (Cairo: 1988), the relevant passages are on 17 and 30, respectively.

<sup>16</sup> Ibn al-Nafis, ‘A., *Kitāb Sharḥ tashrīḥ* 388.

<sup>17</sup> Fancy, *Pulmonary Transit*, ch. 3 and 4. This programme is most explicitly developed in Ibn al-Nafis A. *Theologus autodidactus* (Oxford 1968) [References to pages from the English and Arabic texts are separated by a vertical line]. The title of the English translation by Max Meyerhof and Joseph Schacht is however misleading, as this philosophical novel, a response to Ibn Ṭufayl’s *Ḥayy ibn Yaqẓān*, actually opposes autodidacticism, which contemporary Ṣūfīs advocated through a combination of reason and mystical union with God, see Fancy *Pulmonary Transit* 74–78 and passim. For a brief discussion of Aristotle’s (presumed) hylomorphism see ibidem 201 n. 142, quoting Bos A., “Aristotle’s Psychology: Diagnosis of the Need for a Fundamental Reinterpretation”, *American Catholic Philosophical Quarterly* 73 (1999) 309–331 [which I have not been able to consult].

<sup>18</sup> The verse in question is 17:85, speaking about the *rūḥ* sent by God. Fancy points out, however, that the Qur’ān never uses *rūḥ* with regard to the human soul – yet he also underlines that the distinction between *rūḥ* and *nafs* was not strictly observed in later discussions. Fancy *Pulmonary Transit* 125.

translators and medical philosophers such as Ḥunayn ibn Isḥāq and Qustā ibn Lūqā, who were moving closer towards an earlier Aristotelian concept of one soul connected to the heart as the ‘chief organ’ of the body. Avicenna strongly argued against the corporeality of the soul, which he conceived instead as the final cause of bodily functions such as nourishment, growth, and reproduction – which created a new difficulty: while the Neoplatonic concept of final and efficient causes as transcending their effects allowed for the separation of the soul from the body after death, an insurmountable problem arose when Avicenna was not able to provide a sufficient account for the individuality of the human soul in the grave, given that he had to assume, with Aristotle, that matter was the only possible principle of individuation. This difficulty was compounded by Avicenna’s rejection of bodily resurrection, a position which in the spectrum of thought existing in the Islamic world was acceptable for the followers of *falsafa* (based mainly on ancient Greek philosophy), but anathema to traditionalist scholars following scripture and prophetic traditions (*ahl al-ḥadīth*).

Ibn al-Nafīs, as a Shāfi‘ite jurist, felt closer to the traditionalists, all the while using certain arguments of the *falāsifa*, such as the suggestion that revelation used inexact expressions geared towards the level of understanding accessible to the ‘ignorant masses’, which gave him some leeway for non-literal interpretation of Scripture and, more liberally, the transmitted *ḥadīth*.<sup>19</sup> However, he makes it unmistakably clear that for him, the Qur’ānic exhortations not to deny bodily resurrection are to be taken seriously, while he follows Avicenna’s arguments for the immateriality of the soul. Addressing the hitherto open question of the individuation of an incorporeal soul once the matter to which it had been connected disintegrates after death, Ibn al-Nafīs takes up a concept which has been introduced in the *ḥadīth* literature postulating the existence of a material nucleus of the human being, first created at conception and surviving the demise of the person. ‘This matter is called the *‘ajb al-dhanab*,’ as he says in his *Theologus*, and organs of the body are assembled around this core which is produced through a fine balance of matter at conception, ‘from sperm and similar things, and when the soul becomes attached to it and then begins to feed and to produce the organs, the body is generated

---

<sup>19</sup> Ibn al-Nafīs, *Theologus* 56|27.

from it'.<sup>20</sup> This highly balanced matter, having received the soul emanating from God, is itself imperishable and guarantees bodily resurrection on the Day of Judgement, when 'the soul stirs again and feeds this (nucleus of) matter by attracting other matter to it [...] and therefrom grows a body a second time'.<sup>21</sup>

Thus, for Ibn al-Nafīs the soul is no longer intimately connected with the spirit localised in the left ventricle of the heart, as it was for Avicenna; rather, the spirit (*rūḥ*) is a material substance continuously generated from air and blood, whereas the soul connects with the entirety of the body. The spirit merely serves as a vehicle for the soul. In order to be subtle enough to penetrate the entire matter of the body, Ibn al-Nafīs argues repeatedly, the substances from which the *rūḥ* is produced have to be particularly fine (*raqīq jiddan*), and the process of concoction must not be disturbed by potential corruption through the thick blood which the right ventricle receives from the liver and which first needs to be 'strained' in the lungs, before only its finest components can contribute to the concoction of spirit from the mixture of blood and air through the innate heat present in the heart, which is later to be 'tempered' by the brain. The spirit is then, according to Ibn al-Nafīs, that which 'carries [the soul's] faculties throughout the body'.<sup>22</sup>

In conclusion, we see how Ibn al-Nafīs' anatomical postulate of the impermeability of the heart's central wall follows directly from his natural theological model of the soul's hylomorphic association with the body, mediated through the very fine spirit which is generated in the left ventricle of the heart, not to be unbalanced by thicker components contained in the right chamber. The pulmonary passage of the blood is a necessary corollary of his model<sup>23</sup> and as such not dependent on autopsy: speculations about possible dissections are therefore not warranted except from an anachronistic, at least early modern, perspective.

<sup>20</sup> Ibn al-Nafīs, *Theologus* 58|30. Fancy, *Pulmonary Transit* 148 rejects Meyerhof and Schacht's translation of '*ʿajb al-dhanab*' as 'coccyx', pointing out that Ibn al-Nafīs does not make any reference to an anatomically specific structure. Fancy traces Ibn al-Nafīs' use of this term to the *ḥadīth* scholar and jurist Mālik ibn Anas; *ibidem*.

<sup>21</sup> Ibn al-Nafīs *Theologus* 59|30, addition in round brackets by the editors.

<sup>22</sup> Fancy, *Pulmonary Transit* 214–218, the quote on 214 refers to Ibn al-Nafīs' unedited *Sharḥ al-Qānūn* MS Wellcome Or. 51 [which I have not been able to consult].

<sup>23</sup> This would also explain why Ibn al-Nafīs does not mention the pulmonary passage except in his anatomy commentary, even though practically all his medical works apply the underlying physiological model, Fancy, *Pulmonary Transit* 205.

*Miguel Servet. Martyr for heterodox theology (not medicine)*

As is well known, Servet was engaged in a theological battle that proved fatal to him.<sup>24</sup> Living at a time of Reformation in the Latin Church, he counted on the nascent Protestantism to support his project aimed at doing away with the dogma of the Trinity of God the Father, Son, and Holy Spirit. In his Unitarian approach to the teachings of the Gospels, Servet needed the vital spirit of the arterial blood as a vector for the divine spirit which was inhaled with the air through the lungs, where it is mixed with the finer part of the blood coming from the right ventricle and made into the vital spirit which is then attracted into the left chamber of the heart in diastole and subsequently distributed via the aorta to the arterial system of the body.<sup>25</sup> In order to remove any lingering doubts that there might be any kind of Trinity implied in the Galenic description of the vital, natural, and animal spirits, Servet concludes by stressing that 'In all of these there is the energy of one Spirit and God's Light (Unius spiritus et lucis Dei energia)', and historically it is the vital spirit from the heart that takes precedence over the natural spirit from the liver: It is 'Through inhalation into the mouth and nostrils [that] the soul is truly drawn inwards', and only subsequently, thanks to 'the anastomoses from arteries to veins', can it be 'communicated thence to the liver'.<sup>26</sup> The role of the arterial blood-*cum*-(animal) spirit for the global distribution of the inhaled soul is strongly reminiscent of Ibn al-Nafis' concept which we have just discussed, even though the anatomical corroboration is more solid in Servet's formulations – based on ample experience in the dissection theatre, which allowed him to argue against Galen's assertion that the small dimension of the 'arterial vein' (pulmonary artery) required that some of the blood used in the left ventricle of the heart to concoct the *pneuma* pass through the central septum in the first place.<sup>27</sup> This observation

<sup>24</sup> The classical biography by Bainton R., *Hunted Heretic. The Life and Death of Michael Servetus, 1511–1553* (Boston: 1953) has actually been re-edited more than half a century later (Providence, RI: 2005). A more recent, though somewhat hagiographic work is Hillar M. – Allen C., *Michael Servetus. Intellectual Giant, Humanist, and Martyr* (Lanham: 2002).

<sup>25</sup> Bröer R., "Blutkreislauf und Dreieinigkeit: Medizinischer Antitrinitarismus von Michael Servet (1511–1553) bis Giorgio Biandrata (1515–1588)", *Berichte zur Wissenschaftsgeschichte* 29 (2006) 21–37.

<sup>26</sup> Servetus Michael, *The Restoration of Christianity* (Lewiston: 2007) 241 [169].

<sup>27</sup> Wilson L.G., "The Problem of the Discovery of the Pulmonary Circulation", *Journal of the History of Medicine* 17 (1962) 229–244 discusses the intricate procedures developed by Servet's teacher Winter of Andernach and his fellow student Vesalius to study the large pulmonary vessels in living (dying) animals. Further, Wilson discusses Realdo Colombo's



conversely reinforces the supposition that Ibn al-Nafis' innovations were almost certainly not based on dissection or even vivisection.

It should be noted here that, just as Ibn al-Nafis never speaks of 'circulation', neither does Servet, who describes a 'long passage' of the fine blood 'kept in motion from the right ventricle of the heart'.<sup>28</sup> In the later sixteenth century, the Latin term *circulatio* did indeed make its appearance in physiological writings, as in Andrea Cesalpino's *Questionum peripateticarum libri quinque* (1571/1588); however, as Gweneth Whitteridge has shown in much detail, this word referred to the alchemical concept of heating and cooling in the process of distillation, not to a systemic circular movement of the blood, to the extent that in the post-Harveyan debate, it was sometimes deemed preferable to replace this (originally Aristotelian) notion of *circulatio* by a less charged *circuitio sanguinis*.<sup>29</sup>

Did Servet then have any knowledge of Ibn al-Nafis' anatomical commentary and the physiological ideas it proposed? The question of a possible case of 'plagiarism' has much exercised recent occidentalists. In actual fact, works by 'Ebenfis' had been known in the Republic of Venice and its university town Padua from the early sixteenth century, thanks to the activities of the physician Andrea Alpago and his nephew Paolo.<sup>30</sup> Andrea had been living in Damascus since 1487, exercising the medical profession at the Venetian consulate while studying Arabic medical manuscripts with the help of a local physician, Ibn al-Makki.<sup>31</sup> At the time of the Ottoman conquest of Syria in 1517, he left the Levant and returned to Padua where he and Paolo Alpago published an impressive number of Latin translations of some of the texts collected in Damascus, notably a new translation of Avicenna's *Canon*, but also a short passage from Ibn

---

investigation of the blood-filled venous artery (pulmonary vein) developed into another empirical argument against the original Galenic concept, according to which mainly air and "exhausts" were moving back and forth between the lungs and the left chamber of the heart.

<sup>28</sup> Servetus, *The Restoration* 243 [170] *longo per pulmones ductu, agitur sanguis subtilis*. For Servet, the refinement of the blood starts in the right ventricle of the heart, whereas Ibn al-Nafis envisaged a 'straining' process in the porous (*mutakhalkhil*) tissue of the lungs.

<sup>29</sup> Whitteridge G., *William Harvey and the Circulation of the Blood* (London: 1971). The relevant passages are on 43–44, 66–67, and 126–127. See also Bröer R., "Blutkreislauf" 29.

<sup>30</sup> O'Malley has even argued that a small treatise by Ibn al-Nafis published in Latin in 1547 implicitly contained the concept of a pulmonary passage, though not explicitly mentioning the absence of trans-septal passages. O'Malley C., "A Latin Translation of Ibn Nafis (1547) Related to the Problem of the Circulation of the Blood", *Journal of the History of Medicine and Allied Sciences* 12 (1957) 248–253.

<sup>31</sup> See the detailed biography by Lucchetta F., *Il medico e filosofo bellunese Andrea Alpago (†1522), traduttore di Avicenna* (Padua 1964).

al-Nafis' commentary on that work – though not the relevant section on anatomy, which apparently had often been copied separately from the rest of the text.<sup>32</sup> The papers of the Alpago family were dispersed between the time of Paolo's death (before 1559) and the eighteenth century, at which time a copy of Ibn al-Nafis' anatomical commentary was acquired by the Nani family in Venice.<sup>33</sup> This element of circumstantial evidence is of course quite vague, and therefore historians of medicine had to resort to closer textual analysis in order to establish a possible link between the *Sharḥ al-tashrīḥ* and the *Restitutio*. Soon after Meyerhof's communications, Owsei Temkin undertook the first attempt, pointing out that the two authors in question differed in at least two fundamental anatomical details: one concerning the pores of the septum, which Ibn al-Nafis denied categorically while Servet allowed that some blood would 'sweat through' to the left ventricle, and the other regarding the precise description of the passage of the blood from the arterial vein (pulmonary artery) to the venous artery (pulmonary vein) either through the flesh of the lung (Ibn al-Nafis) or via intermediate vessels (Servet).<sup>34</sup> As we have seen in the section above, Ibn al-Nafis had good reasons to insist on the impermeability of the septum, which would not have been equally stringent for Servet. Also, we have to consider that the latter did have first-hand experience with human dissection, which may well have given him a different perspective on the structure of the cardio-pulmonary system. Therefore, one might be reluctant to follow Temkin, who concluded that these differences make it seem unlikely that Servet had known of the Arabic text.

Joseph Schacht, on the other hand, claims to show convincingly that Servet, more directly than the other candidates among the sixteenth-century anatomists linked to the university of Padua, was dependent on specific ideas gleaned from Ibn al-Nafis's commentary, addressing most of the Egyptian's propositions directly, although contradicting some – presumably on empirical grounds, especially those regarding the relative dimensions of the two ventricles, which Servet may well have observed during his anatomical practice with Winter of Andernach in Paris.<sup>35</sup> There is however further work to be done towards a more comprehensive

---

<sup>32</sup> Iskandar A.Z., *A Catalogue of Arabic Manuscripts on Medicine and Science in the Wellcome Historical Medical Library* (London: 1967) 43–51.

<sup>33</sup> Lucchetta, *Il medico e filosofo*, 60 and n. 2, 66 and n. 5.

<sup>34</sup> Temkin O., "Was Servetus Influenced by Ibn an-Nafis?", *Bulletin of the History of Medicine* 8 (1940) 731–734.

<sup>35</sup> Schacht J., "Ibn al-Nafis, Servetus and Colombo", *Al-Andalus* 22 (1957) 317–336.

comparison of the parallels and differences between the Arabic and the Latin works in their respective wider theological and philosophical contexts.<sup>36</sup>

*Şemsettin İtaki. Eclectic rather than accurate*

It has been commonly asserted, from Meyerhof's international presentation of Taṭāwī's dissertation in the 1930s<sup>37</sup> to recent textbooks on the history of Ottoman medicine, that Ibn al-Nafis' description of the pulmonary passage had been forgotten in the Muslim world, if perhaps not in the West – although it was well known that the manuscript from which Taṭāwī was working dates from the early eighteenth century, so somebody had cared enough about the text to commission a new copy.<sup>38</sup> But the continued scribal tradition is not the only indication of a continued awareness, if not necessarily acceptance, of Ibn al-Nafis' concept. Thus, when looking at the second known illustrated anatomical work in the Islamic world, composed around 1630 by the Ottoman physician Şemsettin İtaki and presented to Sultan Murat IV in 1632 (which was also the first one to be written in the Ottoman Turkish language),<sup>39</sup> we actually find Ibn al-Nafis mentioned by name, in the appropriate section 'On the Ventricles of the Heart'. In order to gain a better understanding of the position İtaki occupies in this debate, it may be useful to quote the context of his assertions more extensively, beginning with the previous section 'On the Anatomy of the Heart':

<sup>36</sup> Such a project can build on the thorough analysis of the relevant protagonists in Fancy, *Pulmonary Transit*. Another essential contribution to this investigation is Bröer R., "Blutkreislauf und Dreieinigkeits".

<sup>37</sup> Meyerhof M., "Ibn an-Nafis (XIIIth cent.) and his theory of the lesser circulation", *Isis* 23 (1935) 100–120.

<sup>38</sup> Brömer R., "Abū al-Ḥasan 'Alā al-Dīn 'Alī ibn al-Ḥazm al-Quraṣī", in Fansa M. (ed.), *Ex oriente lux? Wege zur neuzeitlichen Wissenschaft* (Mainz: 2009) 420–421.

<sup>39</sup> Of the numerous established spelling variants for İtaki's name, I am here going with the modern Turkish rules, while preserving the academic transliteration in the bibliography. There are two editions of his work available, both prepared by Esin Kâhya. The first one (1990) offers a facsimile of one particular manuscript with English translation 'based on a standardised text established by collating seven manuscripts', while the second work (1996) is a critical edition using all seven known manuscripts and providing a modern Turkish translation. Kâhya E., *The Treatise on Anatomy of [the] Human Body and Interpretation of Philosophers by Al-İtāqī* (Islamabad 1990); Kâhya E., *Şemseddîn-i İtâkî'nin resimli anatomi kitabı* (Ankara: 1996). References will be made by year and then first the page number of the Ottoman text followed by the number of the modern translation.

The heart has three cavities. Two of them are large, and the cavity in the middle is smaller than the two others. Some physicians call it a passage. For the other two ventricles open into this cavity [...].

We have already mentioned three ventricles of the heart. All anatomists give the same information. But Ibn an-Nafis in his Commentary on the Anatomical Section of the Qanon claimed that this was wrong, and said that the heart had two ventricles; one of them was the right ventricle in which the blood coming from the liver was cooked, and then sent into the left ventricle where blood was cooked to a certain degree and refined; blood was then sent to the lungs. In the lungs, it mixed with the air and nourished the lungs. The same blood which mixed with air came to the heart [...]. Ibn an-Nafis said that there was no cavity between the right and left ventricles. He also said that they were separated by a fleshy septum which resembled a sponge. The blood passed through this spongy flesh from the right ventricle to the left [...]. Ibn an-Nafis said that the blood which came from the liver was changed into spirit and distributed into the body by the heart. God knows best.<sup>40</sup>

These passages invite broad reflections about the routes of transmission and translation of medical knowledge. What was the ‘best knowledge [...] that ancient scholars have revealed and expressed as human anatomy’, on which İtaki put ‘Turkish clothes and Anatolian covering’?<sup>41</sup> The author provides only sporadic references to his sources, although the editor made a considerable effort to trace possible models for İtaki’s descriptions of the bodily organs.<sup>42</sup> The numerous illustrations present in the earlier copies of his text give some clear indications: there are a number of representations obviously inspired by Vesalius’ Latin work *De humani corporis fabrica libri VII* (1543/1555) [Figs. 1 and 2], and another set of diagrams directly reproduced from Manşūr b. İlyās’ Persian *Tashrīh-i badan-i insān* (before 1400) [Figs. 3 and 4]. Such an eclectic choice of illustrations is certainly surprising, and this selection begs the question as to the understanding of the texts accompanying these treatises.<sup>43</sup> Without venturing into broader generalisations, we may simply analyse the passages just quoted, where we find one very general reference (‘all anatomists’) and one individual name (‘Ibn an-Nafis in his commentary on the anatomical section...’).

<sup>40</sup> Kahya (1990) 204, 205 | 104, 105; Kâhya (1996) 196, 197–198 | 211, 212.

<sup>41</sup> Kahya (1990) 13 | 24; Kâhya (1996) 13 | 122.

<sup>42</sup> Kâhya (1996) 11–109.

<sup>43</sup> There has been an interesting debate about the question of linguistic barriers hindering the reception of foreign sciences in the Ottoman Empire. Kahya – Demirhan Erdemir, *Medicine in the Ottoman Empire* 77; Sarı, N., “Ottoman Medical Practice and the Medical Science”, in Demirhan Erdemir A. – Öncel Ö. (eds.) *Selected Papers on Turkish Medical History* (Istanbul: 2008) 5–89, esp. 20–32.



Fig. 1. Skeleton, from Andreas Vesalius, *De humani corporis fabrica libri septem* (Basel, Oporinus: 1543).



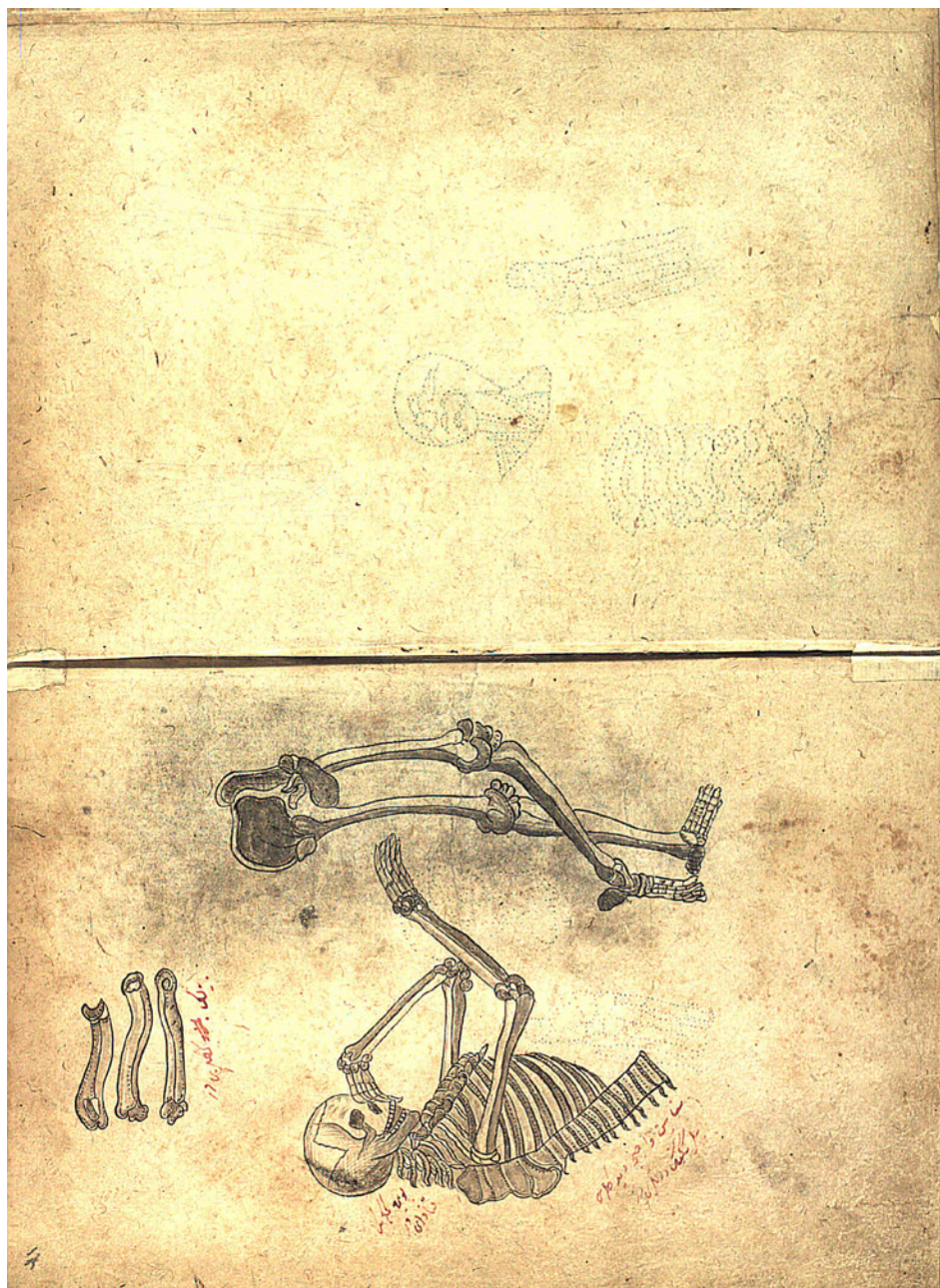


Fig. 2. Skeleton, from Şemsettin İtâkî, *Teşrîh-i Ebdân ve Tercümân Kibâle-i Fezlesûfân* (Hüsrev Paşa 464 fol. 31).

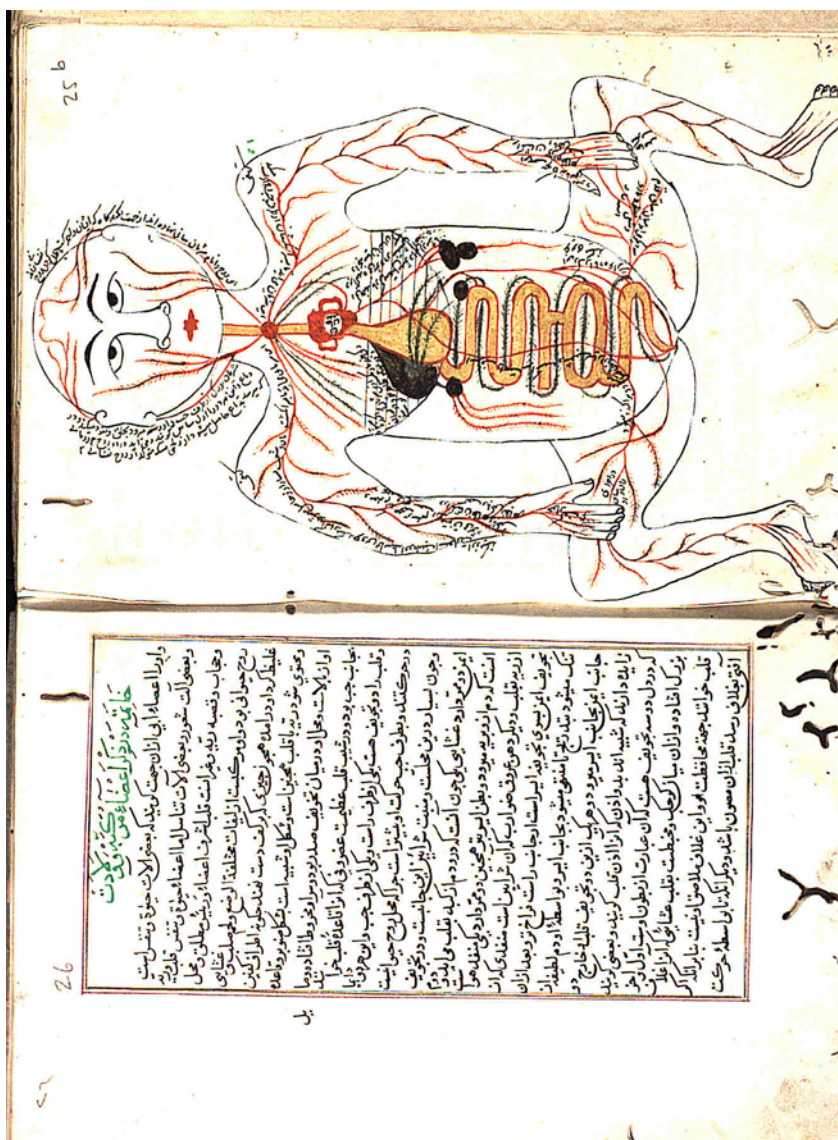


Fig. 3. Venous system from Manšūr ibn Ilyās, *Tashrīh-i badan-i insan*, (Ayasofya 3597 fol 25b).



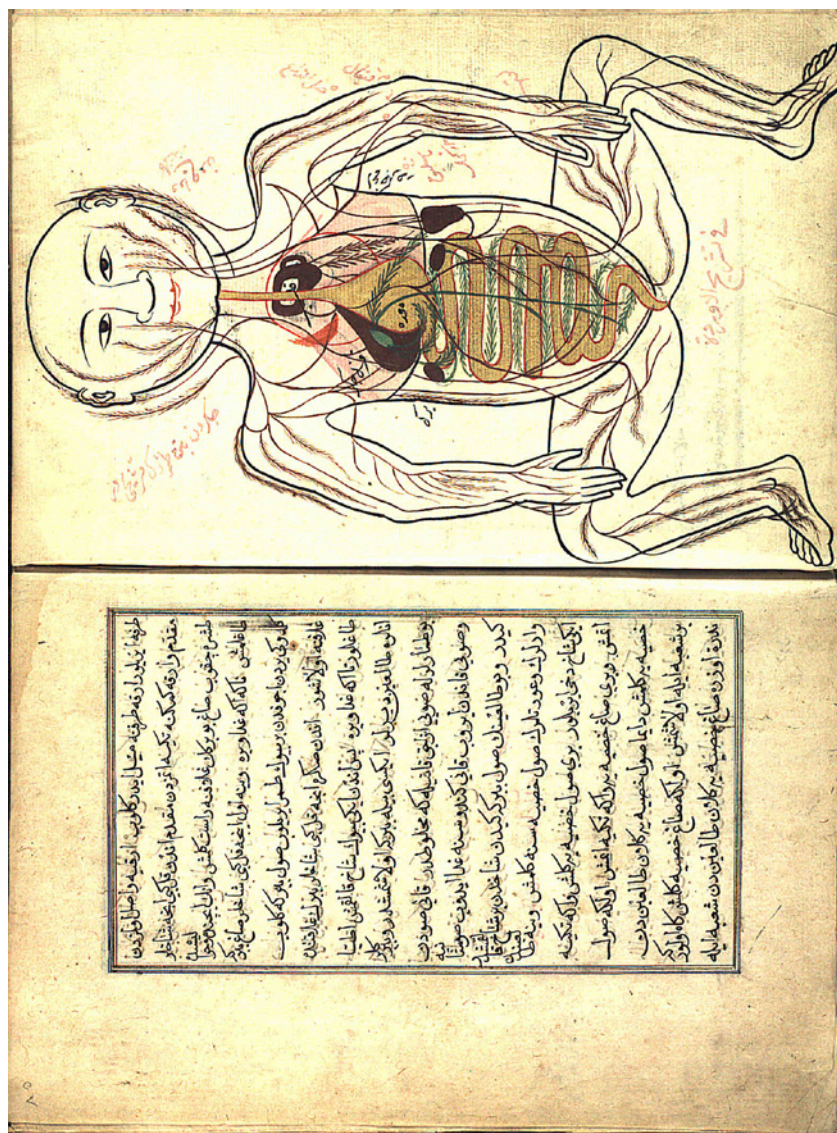


Fig. 4. Venous system from Şemsettin İtâki's *Teşrîh-i Ebdân ve Tercümân Kıldile-i Feylesûfân* (Hüsrev Paşa 46a fol. 84b).

Now it can hardly be said that ‘all anatomists’ in the Islamic world unanimously subscribed to the Aristotelian conviction that there was a middle ventricle in the heart (of larger animals), even though the Galenic ‘connection’ was interpreted in various forms and shapes by authors such as Rhazes, al-Majūsī, and Averroës. But it was only Avicenna who went so far as to postulate a third ventricle.<sup>44</sup>

The Aristotelian view is for instance mentioned in very cautious terms by Manṣūr b. Ilyās, one of Ītaki’s sources: the Persian anatomist complements his description of *two* ventricles (and two auricles) of the heart with a brief remark, saying that ‘[s]ome of the physicians claimed that the heart has three cavities’<sup>45</sup> – certainly not ‘all’. As Ītaki himself acknowledges, Ibn al-Nafīs rejected this claim with his characteristic concise clarity: ‘[Avicenna] said: [the heart] contains three ventricles. This statement is not true. Namely, there are only two ventricles in the heart’. At the same point, Ibn al-Nafīs emphasises that it is wrong to assert that the barrier between the ventricles is rich in porosities (*kathīr al-takhalkhul*), as any leakage of right-ventricular blood into the left chamber would corrupt the essence of the pneuma (*fa-yafsidu jawharahā [al-rūḥ]*).<sup>46</sup> This is of course a far cry from Ītaki’s interpretation of ‘porous flesh’ being present between the ventricles, ‘*mütehelhil et*’ in his words, using exactly the term Ibn al-Nafīs explicitly rejects.<sup>47</sup>

Finally, the rendition of the Cairene scholar-physician’s intricate concept of pneuma as ‘blood [...] from the liver [...] changed into spirit and distributed into the body’ is uniquely laconic, betraying Ītaki’s marked

<sup>44</sup> See the overview in Pioreschi P., *A History of Medicine* vol. IV. *Byzantine and Islamic Medicine* (Omaha, NE 2004<sup>2</sup>) 409–410, based on de Koning’s edition and translation of three classical anatomical texts; Koning P. de, *Trois traités*. Rhazes in his *Kitāb al-Manṣūrī* describes two ventricles and two “auricle-like” accessories (62–65: ‘*zā’idatān shabihatān bi-l-adhnayn*’), mentioning passages (*manāfidh*, [plural! RBr] 62) between the two ventricles. Haly Abbas, on the other hand, in his *Kāmil al-ṣinā’a* engaged critically with the Aristotelian description of a third ventricle, which he rejected: ‘*min al-tajwīf al-ayman ilā ‘l-tajwīf al-aysar manfadh yusammihī qawm tajwīfan thālithan wa-laysa dhalik ka-dhalik*’ (344); ‘*De la cavité droite à la cavité gauche mène un passage [singular! RBr] que quelques-uns appellent troisième cavité, mais il n’en est pas ainsi*’ (345). See also Kāhya (1996) 76–80.

<sup>45</sup> Kāhya E. – Bilgen B. (eds./trs.), *Kitab-ı Teşrihü’l-Ebdan Min e’t Tib. Mansur b. Muhammed b. Ahmed*. (Ankara: 2008) 156.

<sup>46</sup> Ibn al-Nafīs, ‘A., *Kitāb Sharḥ tashrīḥ* 388.

<sup>47</sup> The term *takhalkhul* comes from the same Arabic root as *mütehelhil*, kh-l-kh-l, and in case the Turkish readers did not understand the term, Ītaki adds the Turkish explanation ‘*sünger gibi*’, i.e., ‘sponge-like’, which is not to be found in the Arabic sources.

lack of interest in functional, physiological aspects of human structure. Similarly vague is his description of nerve function, when he states that

the nerves which come out of the brain and go to the eyes [...] were created [...] hollow because light goes through them. But some nerves are not hollow; they are solid; the animal spirit penetrates them as rose water penetrates a rose and oil penetrates sesame.<sup>48</sup>

We may therefore conclude that İtaki definitely knew about Ibn al-Nafis' work, which he cites with its established title, confirming that the *Sharḥ al-tashrīḥ* was far from forgotten in the seventeenth century. At the same time, it is quite obvious that the Ottoman author had little interest in the physiological, let alone the philosophical aspects of his source, quoting the anatomical detail inaccurately to the point where he inverts Ibn al-Nafis' statement about the texture of the flesh (*et*) between the ventricles.

*Ḥasan al-ʿAṭṭār. Scholar for life, one-time physician*

Only recently has the career of Ḥasan al-ʿAṭṭār been reclaimed for the history of medicine.<sup>49</sup> It has to be said that al-ʿAṭṭār devoted only about one decade of his life to medicine, and later focused on disciplines closer to religious sciences (*kalām*, *ḥikma*; grammar, logic; literature [*ādāb*]).<sup>50</sup> He is best remembered for his contributions to Muḥammad ʿAlī Pasha's wide-ranging cultural and technological reforms in Egypt after the French invasion under Napoleon Bonaparte, and his student Rifāʿa al-Ṭaḥṭāwī wrote a famous description of Paris, where he had spent five years as the *imam* of an Egyptian student mission, reporting among other events the French July revolution of 1830.<sup>51</sup> Al-ʿAṭṭār was instrumental in establishing printing in Egypt, and al-Ṭaḥṭāwī's book was probably the first Arabic monograph published directly through the printing press rather than in manuscript

<sup>48</sup> Kahya (1990) 79 | 56; Kâhya (1996) 80|157.

<sup>49</sup> Brömer R., "Kulturgeschichte der Osmanischen Medizin: Anatomie von Ibn al-Nafis und Vesal zu Şanizade und Hasan al-ʿAttār", in Groß D. – Karenberg A. (eds.), *Medizingeschichte im Rheinland* (Kassel: 2009) 267–276.

<sup>50</sup> Gran P., *Islamic Roots of Capitalism*. A second important study concerning al-ʿAṭṭār, apparently written independently from Gran's, is contained in Delanoue G., *Moralistes et politiques musulmans dans l'Égypte du XIX<sup>e</sup> siècle (1798–1882)* (Cairo: 1982) 344–357.

<sup>51</sup> English translation by Newman D., *An Imam in Paris. Al-Tahtawi's Visit to France (1826–1831)* (London: 2002).

form. However, regarding the reception of Ibn al-Nafis' description of the pulmonary passage of the blood, al-'Aṭṭār is another important witness.

Two years after the French had been expelled from Egypt, al-'Aṭṭār left his country and travelled widely across the Ottoman Empire, mainly in and around Anatolia. He spent several years in Istanbul studying and writing about medicine.<sup>52</sup> In 1810, he moved on to Damascus, where he stayed for five more years and for a short time put his medical knowledge into practice. It is from this period that we have a massive, unedited medical treatise of 251 folios, a commentary on a text by the sixteenth-century physician Dawūd al-Anṭākī ('of Antioch'), in which al-'Aṭṭār quotes Ibn al-Nafis at length, and correctly, contrary to what Gran makes of the passage. Commenting on a phrase where al-Anṭākī briefly asserts (with Avicenna) that 'the heart [...] is a conical organ with three cavities',<sup>53</sup> al-'Aṭṭār retorts:

Al-Qurashi [Ibn al-Nafis] said that this view is incorrect, for the heart has two internal ventricles only, one of which is filled with blood, and it is on the right side. The other is filled with vital spirit [*rūḥ*] and it is on the left side. There is absolutely no passageway between the two, nor does the blood penetrate into the side of the spirit, and thereby corrupt [Gran has 'correct'] its essence. Dissection makes a lie of what they have said.<sup>54</sup>

Instead, Gran suggests that al-'Aṭṭār had Ibn al-Nafis believe in the existence of a third ventricle, and makes it sound as if he was correcting the latter. In Gran's translation it therefore reads:

This is the view of al-Qurashī [Ibn al-Nafis], and it is incorrect, for the heart has two internal ventricles only [...] [al-'Aṭṭār concludes with a contrast between the heart in larger and smaller animals].<sup>55</sup>

In the endnotes, Gran adds a rather cryptic remark, saying

---

<sup>52</sup> Gran, *Islamic Roots of Capitalism* 103; exactly how far he went (maybe not as far as Albania) is still a matter of debate; ibidem 192–196.

<sup>53</sup> Al-Anṭākī D., *Nuzhat al-adhhān fī iṣlāḥ al-abdān*: ed. Zakkūr M.Y. (Damascus: 2007) 131 'wa-huwa 'uḍwun ṣanawbarī la-hu thalātha buṭūn'. Gran, *Islamic Roots* 245 n. 3 for 169 does not provide a reference for the copy consulted.

<sup>54</sup> Al-'Aṭṭār H., *Sharḥ al-'Aṭṭār al-musammā bi-rāḥat al-abdān 'alā nuzhat al-adhhān fī 'ilm al-ṭibb* [*Recreation of the bodies on the peregrination of the minds in medical science*] (Damascus 1813, now Cairo Al-Azhar, MS 3434 Riwaq al Maghāriba). The passage in question is on fol. 97 verso, cf. Gran, *Islamic Roots* 170.

<sup>55</sup> Gran, *Islamic Roots* 170. Insertions in square brackets by Gran. The comment about smaller and larger animals echoes Aristotle's assertion that smaller animals had only one ventricle, medium-sized two, and larger three chambers, see Pioreschi, *History of Medicine* 410.

Why on this crucial passage did al-ʿAṭṭār actually agree with al-Qurashī,<sup>56</sup> whose relevant work he cites (p. 35A),<sup>57</sup> and yet claim that he opposed him?<sup>58</sup> Was he undermined by the copyist, or were the ‘circumstances’ in Damascus, which he referred to above, not conducive to an onslaught on Ibn Sīnā?<sup>59</sup>

The last sentence would actually be an interesting thought, were it not based on an inaccurate reading of al-ʿAṭṭār’s text. For the time being, we have to conclude this section by admitting that too little is known about the context of al-ʿAṭṭār’s writing, including the (only recently edited) minor work by al-Anṭākī on which he is commenting, which, as we have seen, only very briefly mentions the existence of three ventricles in the manner of Avicenna. What we can say at this point, however, is that an early nineteenth-century medical student in Istanbul and practitioner in Damascus could have accurate knowledge of Ibn al-Nafīs’ anatomical commentary and would quote him correctly and approvingly, at a time when we have previously been told that the text was ignored in Middle Eastern as well as Western medicine; in fact these two approaches actually met and mingled on the shores of the Bosphorus, where al-ʿAṭṭār had ample opportunities for intellectual exchanges with physicians from Europe.<sup>60</sup>

### Conclusion

Tracking the movement of an isolated ‘factoid’ and its subsequent elaboration in different cultural contexts may be of some interest, mainly in order to dispel irrelevant historical claims of ‘priority’ and ‘plagiarism’. As a by-product, a more continuous pattern of scientific change emerges, both diachronically within one civilisation, the Muslim world from the thirteenth to the early nineteenth century, and geographically between the eastern and north-western Mediterranean. However, when Ibn al-Nafīs, Servet, İtākī, al-ʿAṭṭār, and finally the twentieth-century historians of medicine

<sup>56</sup> He does; RBr.

<sup>57</sup> There, al-ʿAṭṭār cites the *Mūjaz al-Qānūn* (*Epitome of the Canon*), now ed. Murad Y. (Beirut: 2004). Fancy, *Pulmonary Transit* 244–251 provides strong arguments casting doubt on Ibn al-Nafīs’ authorship of this popular abridgement of Avicenna’s *magnum opus*, which actually does not contain any references to the pulmonary passage of the blood – nor to the ‘new physiology’ pervading Ibn al-Nafīs’ other medical works; so the reference would not be relevant to the argument discussed here.

<sup>58</sup> He does not; RBr.

<sup>59</sup> Gran, *Islamic Roots* 245, n. 9 for 170.

<sup>60</sup> Gran, *Islamic Roots* 105, quoting al-ʿAṭṭār *Sharḥ* fols. 70–71.



talk about the structure and function of the cardio-pulmonary system, they are not speaking of the same 'thing', even where they may (or may not) be taking their cues from their respective 'predecessors'. It is only with the benefit of hindsight that we are tempted to align these scholars' works into a tradition of 'discovering the circulation of the blood', which, as we have seen, would not have occurred to the historical actors whose concerns were radically different from one another's – and incommensurable with those of contemporary apologists for particular success stories of one civilisation or another. Rather than pressing Ibn al-Nafis' work into the lineage of William Harvey's physiology, a study of the different ways in which a single anatomical idea was developed and in some cases appropriated by different actors serves to highlight the crucial importance of reflecting the intellectual and wider cultural context in which scholars became convinced that at least some blood passes through the lungs from one side of the heart to the other, and none (or almost none) directly through the central wall between the heart's ventricles. The conceptual continuity, if there is any, between Servet and his presumed predecessor Ibn al-Nafis turns out to be more significant on a natural theological level than in the anatomo-physiological realm, as further studies should be able to demonstrate more comprehensively than has so far been possible.

*Selective bibliography*

- ANṬĀKĪ D., *Nuzhat al-adhhān fī iṣlāḥ al-abdān*: ed. Zakkūr M.Y. (Damascus: 2007).
- ‘AṬṬĀR H., *Sharḥ al-‘Aṭṭār al-musammā bi-rāḥat al-abdān ‘alā nuzhat al-adhhān fī ‘ilm al-ṭibb* [Recreation of the bodies on the peregrination of the minds in medical science] (Damascus: 1813) [now Cairo Al-Azhar, MS 3434 Riwāq al Maghāriba].
- ATTEWELL G., “Islamic Medicines: Perspectives on the Greek Legacy in the History of Islamic Medical Traditions in West Asia”, in Selin H. – Shapiro H. (eds.), *Medicine Across Cultures* (Dordrecht: 2003) 325–350.
- BAINTON R., *Hunted Heretic. The Life and Death of Michael Servetus, 1511–1553* (Boston: 1953).
- BOS, A., “Aristotle’s Psychology: Diagnosis of the Need for a Fundamental Reinterpretation”, *American Catholic Philosophical Quarterly* 73 (1999) 309–331.
- BRÖER R., “Blutkreislauf und Dreieinigkeit: Medizinischer Antitrinitarismus von Michael Servet (1511–1553) bis Giorgio Biandrata (1515–1588)”, *Berichte zur Wissenschaftsgeschichte* 29 (2006) 21–37.
- BRÖMER R., “Abū al-Ḥasan ‘Alā al-Dīn ‘Alī ibn al-Ḥazm al-Quraṣī”, in Fansa M. (ed.), *Ex oriente lux? Wege zur neuzeitlichen Wissenschaft* (Mainz: 2009) 420–421.
- , “Kulturgeschichte der Osmanischen Medizin: Anatomie von Ibn al-Nafīs und Vesal zu Şanizade und Hasan al-‘Attār”, in Groß D. – Karenberg A. (eds.), *Medizingeschichte im Rheinland* (Kassel: 2009) 267–276.
- , “Nutzen und Nutzung der islamischen Medizingeschichte”, in Fansa M. (ed.), *Ex oriente lux? Wege zur neuzeitlichen Wissenschaft* (Mainz: 2009) 202–211.
- CONSTANTINUS AFRICANUS, *Liber Pantegni yssac israelite filii adoptiui Salomonis regis arabie* (Leiden: 1515). Permanent link at Herzog Albrecht Library Wolfenbüttel: <<http://diglib.hab.de/drucke/ma-4f-35/start.htm?image=00463>>.
- DELANOUE G., *Moralistes et politiques musulmans dans l’Égypte du XIX<sup>e</sup> siècle (1798–1882)* (Cairo: 1982), vol. 2.
- FANCY N., *Pulmonary Transit and Bodily Resurrection. The Interaction of Medicine, Philosophy and Religion in the Works of Ibn al-Nafīs (d. 1288)* (Notre Dame: 2006) (PhD thesis).
- FAZLIOĞLU İ., “The Samarqand Mathematical-Astronomical School: A Basis for Ottoman Philosophy and Science”, *Journal for the History of Arabic Science* 14 (2008) 3–68.
- GHAZAL S., “The Discovery of the Pulmonary Circulation: Who should get the Credit: Ibn Al-Nafīs or William Harvey”, *Journal of the International Society for the History of Islamic Medicine* 1 (2002) 46–48.
- GRAN P., *Islamic Roots of Capitalism. Egypt, 1760–1840* (Syracuse NY: 1998) [orig: Austin TX: 1979].
- ḤANAFĪ Ḥ., *Muqaddima fī ‘ilm al-istighrāb (Prolegomena to the Discipline of Occidentalism)* (Cairo: 1991).
- HILLAR M – ALLEN C., *Michael Servetus. Intellectual Giant, Humanist, and Martyr* (Lanham: 2002).
- IBN AL-NAFĪS ‘A., *Al-Mūjaz fī l-ṭibb*: ed. Murad Y. (Beirut: 2004).
- , *Kitāb Sharḥ tashrīḥ al-Qānūn*: ed. Qaṭāya (Catahier) S. – Ghalyūnjī B. (Cairo: 1988).
- , *Theologus autodidactus*: eds./trs. Meyerhof M. – Schacht J. (Oxford: 1968).
- ISKANDAR A.Z., *A Catalogue of Arabic Manuscripts on Medicine and Science in the Wellcome Historical Medical Library* (London: 1967).
- ISSA BEY, A., *Histoire des Bimaristans (hopitaux) à l’époque islamique* (Cairo: 1928).
- KĀHYA E., *Şemseddin-i İtākī’nin resimli anatomi kitabı* (Ankara: 1996).
- , *The Treatise on Anatomy of [the] Human Body and Interpretation of Philosophers by Al-‘Itāqī* (Islamabad: 1990).
- KĀHYA E. – BILGEN B. (eds./trs.), *Kitab-ı Teşrihü’l-Ebdan Min e’t Tıb. Mansur b. Muhammed b. Ahmed* (Ankara: 2008).
- KĀHYA E. – DEMIRHAN ERDEMİR A., *Osmanlıdan Cumhuriyete Tıp ve Sağlık Kurumları* (Ankara: 2000).



- , *Medical Studies and Institutions in the Ottoman Empire (with brief information about the scientific studies)* (Ankara: 2008).
- KONING P. DE (tr.), *Trois traités d'anatomie arabes par Muḥammed ibn Zakariyyā al-Rāzī, 'Alī ibn al-'Abbās et 'Alī ibn Sīnā* (Leiden: 1903).
- LUCCHETTA F., *Il medico e filosofo bellunese Andrea Alpago (†1522), traduttore di Avicenna* (Padua: 1964).
- MEYERHOF M., "El-Tatawi, Mohyi el-Din. Der Lungenkreislauf nach el-Koraschi", *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften* 30 (1931) 55–57.
- , "Ibn an-Nafis und seine Theorie des Lungenkreislaufs", *Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin* 4 (1933) 37–88 [7+15 pp. Arabic text].
- , "Ibn an-Nafis (XIIIth cent.) and his Theory of the Lesser Circulation", *Isis* 23 (1935) 100–120.
- NEWMAN D., *An Imam in Paris. Al-Tahtawi's Visit to France (1826–1831)* (London: 2002).
- O'MALLEY C., "A Latin translation of Ibn Nafis (1547) Related to the Problem of the Circulation of the Blood", *Journal of the History of Medicine and Allied Sciences* 12 (1957) 248–253.
- PERHO I., "The Prophet's Medicine: A Creation of the Muslim Traditionalist Scholars", *Studia Orientalia* 74 (1995) 1–158.
- PORMANN P. – SAVAGE-SMITH E., *Medieval Islamic Medicine* (Edinburgh: 2007).
- PRIORESCHI P., *A History of Medicine vol. IV. Byzantine and Islamic Medicine* (Omaha NE: 2004<sup>2</sup>).
- SARI, N., "Ottoman Medical Practice and the Medical Science", in Demirhan Erdemir A. – Öncel Ö. (eds.) *Selected Papers on Turkish Medical History* (Istanbul: 2008) 5–89.
- SAVAGE-SMITH E., "Attitudes Toward Dissection in Medieval Islam", *Journal of the History of Medicine* 50 (1995) 67–110.
- SCHACHT J., "Ibn al-Nafis, Servetus and Colombo", *Al-Andalus* 22 (1957) 317–336.
- SERVETUS MICHAEL, *The Restoration of Christianity*. Trs. Hoffman C. – Hillar M. (Lewiston: 2007).
- SEZGIN, F. (ed.), *'Alī ibn abi l-Ḥazm al-Qarshī Ibn al-Nafīs (d. 687/1288). Texts and Studies* (Frankfurt: 1997).
- SIRAIISI N., *Medieval & Early Renaissance Medicine* (Chicago: 1990).
- TATAWI M., *Der Lungenkreislauf nach el-Koraschi*. Diss. med. (Freiburg: 1924).
- TEMKIN O., "Was Servetus Influenced by Ibn an-Nafīs?", *Bulletin of the History of Medicine* 8 (1940) 731–734.
- WHITTERIDGE G., *William Harvey and the Circulation of the Blood* (London: 1971).
- WILSON L.G., "The Problem of the Discovery of the Pulmonary Circulation", *Journal of the History of Medicine* 17 (1962) 229–244.
- ZAYDAN Y., *'Alā' al-Dīn (Ibn al-Nafīs) al-Qarashī – i'ādat iktishāf* (Abu Dhabi: 1999).

SPERM AND BLOOD, FORM AND FOOD.  
LATE MEDIEVAL MEDICAL NOTIONS OF MALE AND FEMALE  
IN THE EMBRYOLOGY OF *MEMBRA*

Karine van 't Land

*Summary*

According to late medieval medical authors, human bodies consisted of hard, noble, white, and sustaining parts, the spermatic *membra*, and of soft, inferior, red, and filling parts, the sanguinary *membra*. These two types of *membra* were formed within the developing body of the embryo. While sanguinary *membra* were derived solely from menstrual blood, spermatic *membra* came from male and female sperm.

The central question in this paper is: what connections existed between generation and nutrition in the embryology of spermatic and sanguinary *membra* in late medieval academic medicine, and how did these connections function in the construction of notions of male and female in early physiology? Commentaries on the chapter discussing *membra* in Avicenna's *Canon* (I.1,5,1) form the main sources.

In the paper, many ties between generation and nutrition are described. Most significant for answering the paper's central question is, however, the strong and consistent connection between the female contribution to generation and nourishment, which was in line with broader cultural assumptions about the female role in society. Sanguinary *membra* came about when the spermatic *membra* started to be nourished. Later in life, the soft sanguinary *membra* would be easily replaceable by material which had entered the body as nourishment. The spermatic *membra*, on the other hand, were just as irreplaceable as they were indispensable for the continuing existence of the body, reflecting contemporary ideas about masculine superiority and about sperm as the inimitable core of the human body.

*Introduction*

In early thought about physiology, the dividing lines between generation on the one hand, and nutrition and growth on the other were intriguingly fuzzy. Learned medieval physicians found it difficult to establish the precise difference between the constitution of an embryo during generation, and the bringing about of new tissue in nutrition. Many other facts in

early physiology confirmed the tight connections between nutrition and generation. For instance, nutrition and generation both were capacities of the nutritive soul, the sperm necessary for generation was also a product of food, the uterus had a mouth just like the one in the face, and female sperm functioned as nourishment for male sperm.

It is innovative to study early embryology not as an isolated strand of thought, but as a subject tightly linked to nutrition through bonds of metaphors and parallels, with only vague boundaries separating the two processes.<sup>1</sup> Through this new research trajectory, I hope to throw new light on the notions of male and female within medieval physiology.<sup>2</sup> Much has been said already – and therefore I can safely summarise the debate – about the supposedly misogynist theory of Aristotle concerning the generation of the embryo, and its supposedly more liberating counterpart devised by Galen. Aristotle claimed that form was brought upon the embryo entirely by male sperm, which would refrain equally entirely from becoming part of the embryo. Female blood would provide only matter for the embryo. Galen wrote about the ovaries, the female

---

<sup>1</sup> For embryology in the Middle Ages see, for instance: Brisson L. et alii (eds.), *L'embryon. Formation et animation. Antiquité grecque et latine, traditions hébraïque, chrétienne et islamique* (Paris: 2008); Elsackers M., "The Early Medieval Latin and Vernacular Vocabulary of Abortion and Embryology", in Goyens M. et alii (eds.), *Science Translated. Latin and Vernacular Translations of Scientific Treatises in Medieval Europe* (Turnhout: 2008) 377–413; Ziegler J., "The Scientific Context of Dante's Embryology", in Barnes J.C. – Petrie J. (eds.), *Dante and the Human Body. Eight Essays* (Dublin: 2007) 61–88; Cilliers L., "Vindicianus' Gynaecia: Text and Translation of the Codex Monacensis (Cm 4622)", *Journal of Medieval Latin* 15 (2005) 153–236; Lugt M. van der, *Le ver, le démon et la vierge. Les théories médiévales de la génération extraordinaire* (Paris: 2004); Martorelli Vico R., *Medicina e filosofia. Per una storia dell'embriologia medievale nel XIII e XIV secolo* (Naples: 2002); Pahta P., *Medieval Embryology in the Vernacular. The Case of De Spermate*, *Mémoires de la Société Néophilologique de Helsinki* 53 (Helsinki: 1998); Cadden J., *Meanings of Sex Difference in the Middle Ages. Medicine, Science and Culture* (Cambridge: 1993); Dunstan G.R. (ed.), *The Human Embryo. Aristotle and the Arabic and European Traditions* (Exeter: 1990); Demaitre L. – Travill A.A., "Human Embryology and Development in the Works of Albertus Magnus", in Weisheipl J.A. (ed.), *Albertus Magnus and the Sciences. Commemorative Essays 1980* (Toronto: 1980) 405–440; Hewson M.A., *Giles of Rome and the Medieval Theory of Conception* (London: 1975). For medieval theory of nutrition see: Reynolds P.L., *Food and the Body. Some Peculiar Questions in High Medieval Theology* (Leiden: 1999); Cadden J., "Albertus Magnus' Universal Physiology: The Example of Nutrition", in Weisheipl, *Albertus Magnus and the Sciences* 321–339; Cadden J., *The Medieval Philosophy and Biology of Growth. Albertus Magnus, Thomas Aquinas, Albert of Saxony and Marsilius of Inghen on Book I, Chapter V of Aristotle's De Generatione et Corruptione, with Translated Texts of Albertus Magnus and Thomas Aquinas* (Dissertation Indiana University: 1971).

<sup>2</sup> In tracing the imagery of embryology and femininity in medical texts, I am following King H., "Making a Man: Becoming Human in Early Greek Medicine", in Dunstan (ed.), *The Human Embryo* 10–19, where the image of the female as soil is discussed.

testicles, and stated that females did secrete true semen, capable of giving form, although weaker than that of the male. In Galen's eyes, male sperm also provided matter for the embryo, although to a considerably lesser extent than that of the female. In her short account of the controversy and its historiography, Joan Cadden rightly refrained from seeing the theories themselves as either misogynist or feminist.<sup>3</sup> However, she clearly described the huge gap these authors created between the male and the female, the clear hierarchy between the two principles, and the role which the classical theories played in establishing both the gap and the hierarchy.<sup>4</sup>

Taking full account of the relationships between generation and nutrition might, I suspect, offer a new approach to the discussion about male and female principles. *Generatio* counted as a truly masculine act – females could only conceive and give birth, as van der Lugt concluded after investigating medieval encyclopaedias and dictionaries.<sup>5</sup> On the other hand, the connection between femininity and nourishment was firmly rooted in medieval culture, and can even be applied to almost every human culture. Seen from a cross-cultural perspective, food is a resource controlled by women.<sup>6</sup> Women feed their husbands, their children, and other family members. There are many grounds for this widespread association of women and the nourishment of others, but one powerful reason seems to be the biological analogy. Women feed the foetus in their wombs, secrete milk for their newborn babies, and continue to provide food when the child grows, and biological necessity diminishes.<sup>7</sup>

In order to bring together the subjects of generation and nutrition and the male and the female, spermatic and sanguinary *membra* will function as a case study here. The concept of *membrum* in late medieval learned medicine is very specific, and I will therefore use the term without translation. Sometimes, the word *membrum* seems to suggest modern tissues or structures, like all the arteries in the body. At other times, learned authors denoted complete parts of the body, such as hands, by the term. And then again, they could also discuss modern 'organs', like the liver, under the

<sup>3</sup> Cadden, *Meanings of Sex Difference* 117, further bibliography in n. 23.

<sup>4</sup> Cadden, *Meanings of Sex Difference* 119–130.

<sup>5</sup> Lugt van der, *Le ver, le démon et la vierge* 37–38.

<sup>6</sup> Sanday P.R., *Female Power and Male Dominance. On the Origins of Sexual Inequality* (Cambridge: 1981) 76–77.

<sup>7</sup> Walker Bynum C., *Holy Feast and Holy Fast. The Religious Significance of Food to Medieval Women* (Berkeley etc.: 1987) 190.

heading of *membrum*. The creation of matter for *membra* counted as the final stage of nutrition, while the creation of the *membra* of the embryo was a final stage of generation. Because *membra* functioned as the end stage for both processes, they are an ideal subject for investigating the ties between the two.

Spermatic *membra* were, simply put, the hard and white parts of the body, sustaining and structuring it. The sanguinary *membra* were soft flesh and fat, filling up the empty spaces between the spermatic *membra*. They were created in the early development of the embryo, and continued to exist during the whole life cycle of the body. Therefore, they needed to be fed, both inside the womb, and after the human being had been born. The idea of spermatic and sanguinary *membra* has received little attention in modern historiography of science.<sup>8</sup> Aristotle stated that some *membra*, like bones and sinews, were formed from a spermatic residue.<sup>9</sup> Galen expanded this theory in his treatise *De spermate*,<sup>10</sup> and Ibn Sina used it in his *Qanun*.<sup>11</sup> In the late Middle Ages, the idea of spermatic and sanguinary *membra* belonged to the realm of medicine. A philosopher and theologian like Giles of Rome, when writing on embryology, tried very hard to dismiss the theory of spermatic and sanguinary *membra*.<sup>12</sup> Yet traces of the body's division into spermatic and sanguinary *membra* can be found in late medieval philosophical works as well.<sup>13</sup>

The subject of the two types of *membra* forms a valuable way of studying maleness and femaleness, because of the notions attached to sperm and blood. The two different types of *membra* were created during the gestation of the embryo out of sperm and menstrual blood, as indeed was the whole embryo. The spermatic and sanguinary nature of the different types of *membra* might suggest a direct relation to male sperm and female menstrual blood: that spermatic *membra* would come from masculine sperm, and sanguinary ones from menstrual blood. The relations between the generative substances and the *membra* were not that clear-cut, however.

---

<sup>8</sup> Cadden mentioned the medical idea of spermatic parts in her account of the question of whether the sperm of the father became part of the embryo: Cadden, *Meanings of Sex Difference* 128–130. As will be discussed below, spermatic parts were supposed to have their origin at least mainly in female sperm as well. Other authors mentioned the idea in passing, e.g. Lugt van der, *Le ver, le démon et la vierge* 51, and Ziegler, “The Scientific Context of Dante’s Embryology” 81.

<sup>9</sup> Aristoteles, *De generatione animalium* 744b–745b.

<sup>10</sup> Galenus, *De semine* (4.512–651 K.).

<sup>11</sup> In its Latin translation: Avicenna, *Canon* I.1.5,1 *Quid sit membrum et sue partes*.

<sup>12</sup> Hewson, *Giles of Rome* 78–85.

<sup>13</sup> Cadden, *Meanings of Sex Difference* 128–130.

The confusing nature of the terminology forced the medieval authors to be extremely scrupulous – even more scrupulous than they would otherwise have been – about their language, and about their explanations as to how, for instance, female sperm from menstrual blood formed the basis for spermatric *membra*.

The central question in this paper is: what connections existed between generation and nutrition in the embryology of spermatric and sanguinary *membra* in late medieval academic medicine, and how did these connections function in the construction of notions of male and female in early physiology? As the learned physicians of the fourteenth and fifteenth centuries studied embryology within a thoroughly Aristotelian framework, some attention will also be given to the links between the two physiological processes in Aristotle's writings.

As sources, I will use commentaries on the chapter discussing *membra* in Avicenna's *Canon*.<sup>14</sup> The Latin translation of Ibn Sina's *Qanun* counted as a highly reliable and comprehensive encyclopaedia of medicine in the late Middle Ages. Not many authors ventured into writing a commentary on the great work. Four university physicians included the chapter on *membra* in their commentaries on the *Canon*. These were the Italians Gentile da Foligno († 1348),<sup>15</sup> Jacopo da Forlì († 1414)<sup>16</sup> and Ugo Benzi († 1439),<sup>17</sup> and the Flemish physician Jacques Despars († 1458).<sup>18</sup> Their texts will form the main corpus of sources in this paper.<sup>19</sup> The learned medical debate about embryology was a lively one in their days, and

<sup>14</sup> Avicenna, *Canon* I.1,5,1. For the role of the *Canon* in medieval medical learning, see Siraisi N.G., *Avicenna in Renaissance Italy. The Canon and Medical Teaching in Italian Universities after 1500* (Princeton NJ: 1987) 43–76; Jacquart D., "Lectures universitaires du Canon d'Avicenne", in Janssens J. – Smet D. de (eds.), *Avicenna and his Heritage. Acts of the International Colloquium, Leuven – Louvain-la-Neuve, September 8–September 11, 1999* (Louvain: 2002) 313–324.

<sup>15</sup> French R., *Canonical Medicine. Gentile da Foligno and Scholasticism* (Leiden etc.: 2001) 1–50.

<sup>16</sup> Ottosson P.-G., *Scholastic Medicine and Philosophy. A Study of Commentaries on Galen's Tegni (ca. 1300–1450)* (Naples: 1984) 53–58.

<sup>17</sup> Lockwood D.P., *Ugo Benzi. Medieval Philosopher and Physician (1376–1439)* (Chicago: 1951) 1–32.

<sup>18</sup> Jacquart D., "Le regard d'un médecin sur son temps: Jacques Despars (1380?–1458)", *Bibliothèque d'humanisme et Renaissance. Travaux et documents* 138 (1980) 35–77.

<sup>19</sup> For Gentile da Foligno and Jacques Despars: *Hic merito inscribi potens vite liber corporalis Abohali Abynscei canonis libros quinque duplici fere per totum commento munitos nuperque translatos [...] doctores circa textum positi ut locis suis apparebit hi sunt: Gentilis de Fulgineo et alii* (Venice: 1503); for Jacopo da Forlì: *Expositio et quaestiones in primum Canonem Avicennae* (Venice: 1547); for Benzi Ugo: *Expositio Ugonis Senensis super primo Canonis Avicenne cum questionibus eiusdem* (Venice: 1498).

strongly oriented towards Aristotle's writings. They must have been familiar with the main contemporary texts on embryology, in which *Canon* commentaries figured prominently.<sup>20</sup>

*Generation, nutrition and growth in Aristotle's thought*

According to Aristotle, generation was a multi-faceted phenomenon. He investigated generation within three of his main areas of thought, namely physics, psychology, and biology. In physics, he considered generation as coupled to corruption, and as one of the processes bringing about change. In Aristotle's psychology and biology, the term generation meant the reproduction of living organisms; plants, animals, and humans. Both the philosopher himself and his medieval followers distinguished these two types of generation from one another, and saw them as different processes.<sup>21</sup>

As for physics, Aristotle exposed some of the fundamental problems of generation in the treatise *On Generation and Corruption*.<sup>22</sup> Here he compared coming-to-be or generation, change and growth with one another. He focused on the differences between the processes of change. While he envisaged these types of change in lifeless things, such as fire, they were of great importance for living organisms as well. In his biology and psychology, Aristotle clearly showed the difficulty of drawing a line between nutrition and generation, or between creating new tissue and creating a new being. He often discussed the similarities between generation and nutrition in living organisms. In the treatise *On the Soul*, Aristotle explained that nutrition, growth and generation all belonged to the nutritive soul.

---

<sup>20</sup> See Martorelli Vico, *Medicina e filosofia*; Ziegler, "The Scientific Context of Dante's Embryology" 75–76. Mondino de' Liuzzi († 1326), Tomasso del Garbo († 1370) and Jacopo da Forlì wrote subsequent commentaries on the chapter about the generation of the embryo in the *Canon*: *Canon* III. 21.doctrina 1. capitulum 2. One other commentary on this *Canon* chapter has been ascribed to Dino del Garbo († 1327), but Siraisi asserted that this commentary cannot be truly his: Siraisi N., *Taddeo Alderotti and his Pupils. Two Generations of Italian Medical Learning* (Princeton: 1981) 200, note 142. Dino wrote a commentary on Hippocrates' treatise *De natura fetus*. Pietro Torrigiano de' Torrigiani († ca. 1320) wrote about embryology in his text *Plusquam commentum*, just like Pietro d'Abano († ca. 1316) in his *Conciliator*.

<sup>21</sup> Lugt van der, *Le ver, le démon et la vierge* 33–35.

<sup>22</sup> For detailed discussions of the text, and bibliography, see Haas F. de – Mansfeld J. (eds.), *Aristotle. On Generation and Corruption, Book I, Symposium Aristotelicum* (Oxford: 2004).



He discussed generation as a separate phenomenon in *On the History of Animals*, in book VI and VII, and chiefly in *On the Generation of Animals*. I will use *On Generation and Corruption*, *On the Soul* and *On the Generation of Animals* as source material here. At the end of the section, I will say a few words about Aristotle's influence on Avicenna and on the Western university physicians.

In *On Generation and Corruption*, Aristotle studied coming-to-be and passing-away, alteration and growth, as he announced in the first lines of the treatise. These were three forms of change for the sublunary world. The exact nature of worldly changes had been difficult to define in the history of philosophy. For those presocratic authors, for instance, who maintained that the universe was made out of a single 'something', alteration and generation would be the same kinds of change. If everything was composed from the same matter, the generation of a new thing would mean merely an alteration of the universal matter. Thus, the ties between generation and other types of change were established at the very start of the era of philosophical reasoning. For thinkers like Aristotle, however, who presupposed that the world was constructed from more than one basic material, the generation of new things would differ from alteration.<sup>23</sup>

Aristotle paid a great deal of attention to analysing the nature of generation, alteration, and growth, and only a very rough outline of his ideas on these subjects can be provided here. When the qualities of a substance changed, but the substance itself did not, the process of change could be either growth or alteration. The change would be growth (or its counterpart, diminution), if it could be defined in terms of magnitude or quantity. Alteration took place if one or more qualities of the changing thing altered.<sup>24</sup> According to Aristotle, generation would be a change of the substance itself. The thing would change as a whole, for instance when seed was changed into blood, or water into air.<sup>25</sup>

The philosopher dedicated a whole chapter of Book I of *On Generation and Corruption* to growth. After a thorough investigation, he identified as the fundamental difference between growth and generation the point that, during growth, some magnitude acquired a new form within a substance which already existed, while in generation, a magnitude would acquire a new form and become a new substance. Aristotle used fire and wood as

<sup>23</sup> Aristoteles, *De generatione et corruptione* 314a–314b.

<sup>24</sup> Arist. *GC* 319b–320a.

<sup>25</sup> Arist. *GC* 319b.

an example. If the fire already existed when new wood was added to it, it would grow. When, on the other hand, a pile of wood was set on fire, this would mean a generation of fire.<sup>26</sup> In this way, the difference between the processes of growth and generation became clear: at the start of the generation of a fire, there was no fire, but when fire began to grow, there was already a fire. The example also shows, however, how close generation and growth remained to one another.<sup>27</sup> In both cases, the fire was fed with fuel, and expanded in terms of space.

Aristotle thus carefully distinguished generation, growth, and change from one another. All these processes affected everything material, including humans. In his doxography, Aristotle described how coming-to-be and change had been one and the same for philosophers accepting just a single universal matter. He disagreed with them but, as his own subtle reasoning proves, he too found it difficult to draw firm boundaries between the different processes.

Aristotle also investigated processes like generation and growth as part of the physiology of living organisms. Nutrition, growth, and generation were tied to one another in Aristotle's biology. These functions were all capacities of the nutritive soul, the main function of which was the preservation of that which existed. The organism itself was preserved as well as possible through the capacity of nutrition, while the capacity of reproduction performed the same function of continuation, but on the level of the species.<sup>28</sup> As Aristotle stated, the nutritive soul distinguished itself from the other souls by its use of food.<sup>29</sup>

And indeed, all three capacities depended on the assimilation of food to the body. For nutrition and growth this may seem obvious, but generation too was ultimately facilitated by food. Aristotle saw male semen and female menstrual blood, which constituted the formal and material cause of generation respectively, as useful by-products of nutriment in the final stage of digestion. Both were derived from blood, which for Aristotle was equal to almost completely assimilated food.<sup>30</sup> In order to prove his case, Aristotle pointed to the relative infertility of fat people. As the food they ate had apparently been turned into fat, there was little left for the

---

<sup>26</sup> Arist. *GC* 322a.

<sup>27</sup> Cadden, *The Medieval Philosophy and Biology of Growth* 10–11.

<sup>28</sup> Aristoteles, *De anima* 416b.

<sup>29</sup> Arist. *De An.* 416a.

<sup>30</sup> Aristoteles, *De generatione animalium* 726a; 766b.

production of semen, and hence it was difficult for them to conceive.<sup>31</sup> The exhaustion people felt after coitus was further clear proof of the fact that the production of sperm cost precious nutriment, in the final stage of digestion. So even if just a little was excreted, it would be sorely missed. Admittedly, a few young people could feel relieved after emitting an excess of semen. This rare phenomenon should be understood as the relief people could feel after vomiting, when they had removed an excess of food from their bodies.<sup>32</sup> Children did not produce semen, as they used all their nourishment for growth.<sup>33</sup>

When creating the embryo, the male semen forced form on the female matter. Aristotle described this process as analogous to growth in two ways. First, the materials used to compose human matter were comparable, as both menstrual blood (in the generation of the embryo) and normal blood (in growth) were products of food, which closely resembled one another. Secondly, the way in which flesh was formed was, in essence, the same for the generation of the embryo and for the growth of members in a later stage of life. In both processes of formation, matter took on a new form, while it was guided by the bearer of this same new form.<sup>34</sup> Thus, it was quite logical to presume that the nutritive soul was the driving force behind both the creation of the embryo out of semen and menstrual blood, and the incorporation of new matter in a growing member.

Aristotle also devoted attention to the role of nutrition in the development of the embryo. He stated that the matter which the female provided potentially contained the nutritive soul, so that it could grow and be fed. Because female matter did not contain other potential parts of the soul, female animals needed male animals as well in order to produce living offspring. The sensitive soul, necessary for the formation of animal parts, could only be found in male semen.<sup>35</sup> Some parts of the embryo were formed from the seminal secretion, like bones, sinews, and hairs. After formation, they would grow from nutriment like all other parts.<sup>36</sup>

In the text *On the Soul*, Aristotle focused on the similarities between the physiological processes of generation, nutrition and growth in the living organism. He explained why the three should be taken together in

---

<sup>31</sup> Arist. *GA* 725b–726a.

<sup>32</sup> Arist. *GA* 725b.

<sup>33</sup> Arist. *GA* 725b.

<sup>34</sup> Arist. *GA* 740b–741a.

<sup>35</sup> Arist. *GA* 741a.

<sup>36</sup> Arist. *GA* 744b–745b.

the nutritive soul, and therefore stressed the parallels between them. The nutritive soul had food as its object, and formed the basis of the enduring existence of both the individual and the species. In other biological works, like *On the Generation of Animals*, he discussed links between nutrition and generation in more detail. The origins of semen in food formed a major link, just like the nourishing function of menstrual blood. So, whether Aristotle discussed the coming-to-be, growth and decline of fire, or investigated the generation, nutrition and growth of a human child, he perceived the processes under scrutiny as difficult to separate from one another, with many connections and likenesses.

Aristotle's ideas on generation and nutrition were highly influential, both in the Arabic world of Avicenna and in the late medieval Western universities. The three works *On Generation and Corruption*, *On the Soul*, and *On the Generation of Animals* were well-known to Avicenna and his late medieval Western commentators. *On the Generation of Animals* had become part of the larger work *On Animals* (books XV–XIX), which brought together the latter treatise with *On the History of Animals* and *On the Parts of Animals*. Michael Scot († ca. 1235) translated both the Arabic translation of Aristotle's *On Animals* and Avicenna's commentary on this work into Latin.<sup>37</sup>

Avicenna was both philosopher and physician, and he was therefore versed in both Aristotelian and Galenic theories of generation. He did not try to hide the differences between the two. Although he adopted Aristotle's main ideas on generation, he made room for Galenic adaptations. Avicenna accepted Galen's idea that female seed, derived from the female testicles, was necessary for generation. He also followed Galen in stating that male sperm became part of the embryo. Avicenna's main discussions of generation can be found in the *Canon*, III.21–22 and in his commentary on *On Animals*, IX.1–5.<sup>38</sup>

Late medieval university masters usually were far stricter Aristotelians than Avicenna in their ideas about generation. This counted even for university physicians commenting on Galen's *Tegni*. Van der Lugt explained

<sup>37</sup> A.M.I. van Oppenraay is currently preparing editions of these two large bodies of text for the projects *Aristoteles Semitico-Latinus* and *Avicenna Latinus*, based at the Huygens Instituut, The Hague. The edition of Scotus' translation of *On the Generation of Animals* is already available: Aristotle, *De animalibus*. Michael Scot's Arabic-Latin Translation. Part Three, Books xv–xix. *Generation of Animals*, Aristoteles semitico-latinus (Leiden: 1992), vol. 5.

<sup>38</sup> Lugt van der, *Le ver, le démon et la vierge* 61; Cadden, *Meanings of Sex Difference* 106–110.

the phenomenon by pointing out that the medieval physicians could not in any way observe the process of conception. Left to rely on theorising, they resorted to the systematic training in Aristotelian logic and metaphysics which they had received before moving on to medicine.<sup>39</sup> When these same masters were confronted with Avicenna's slightly aberrant ideas, they could react with confusion, as will be seen below.

*Generation and nutrition of membra in late medieval university medicine*

Four university masters, Gentile da Foligno, Ugo Benzi, Jacopo da Forlì, and Jacques Despars, wrote a commentary on Avicenna's *Canon* which included the chapter on *membra* or parts.<sup>40</sup> The authors understood quite well the main difference between their own theorising about generation and that of Aristotle in *On Generation and Corruption*. As Jacques Despars explained:

Note that, admittedly, generation in its proper meaning would be the sudden change of a substance out of not being into being, as Aristotle said [...]. However, the concept is used in a different way by physicians, who just speak about the generation of animals. They then take generation as the function of the generative capacity [of the soul], which transforms sperm and blood from being an animal in potential to being an animal in act.<sup>41</sup>

While Aristotle had had in mind an abstract concept, applicable to the coming-to-be of all natural substances, physicians thought of sperm and blood coming together, and forming a new animal. They concentrated exclusively on the physiological side of coming-to-be.

For these physicians too, the boundaries between generation and nutrition were sometimes vague. Following Aristotle's biology, they shared his uncertainties. When an embryo was generated out of sperm and blood, something grew, and it would continue to grow. Where would the first phase of growth, namely that of generation, end and where would the second phase, that of a growing embryo, begin? Indeed, the menstrual

<sup>39</sup> Lugt van der, *Le ver, le démon et la vierge* 76–77.

<sup>40</sup> Avicenna, *Canon* I.1,5,1, entitled *Quid sit membrum et sue partes*.

<sup>41</sup> Despars Jacques, *Canon* I.1,6,2 'Attende secundo quod licet generatio proprie dicta sit mutatio instantanea ad substantiam de non esse ad esse ut ait Aristoteles .5. phisicorum. Aliter tamen a medicis de sola generatione animalium loquentibus accipitur generatio pro operatione generative virtutis qua sperma et menstruum paulatim transmutantur ab esse animal in potentia ad esse animal actu'.

blood which provided matter for generation also fed the growing embryo. And once the embryo had left the womb, the first food the baby would receive was mother's milk, which was supposed to be produced from menstrual blood, conveyed to the breast. Only very gradually would other foodstuffs start to play a role in the nutrition and growth of the child, making the analogy of menstrual blood with food all the more immediate.

While writing about *membra*, the late medieval physicians clearly showed that they associated nutrition with generation. Their source text, the *Canon* chapter on *membra*, connected *membra* only to nutrition. Avicenna defined *membra* as a series of comings-to-be in the full-grown man. Elements became food, food became humours, and humours became *membra*.<sup>42</sup> Still, the commentators often discussed embryology in the asides of their commentaries. Jacopo da Forlì and Gentile da Foligno bracketed nutrition and generation of the embryo together in at least three ways, for instance, when they investigated the transformation of humours into *membra*. They envisaged analogies between the two processes in the materials used, in the nature of the mutations, and in the driving force behind the process.

First of all, the commentators saw the materials which changed into *membra* as comparable for the two processes. Humours indeed became *membra*, Jacopo explained: secondary moistures turned into *membra* during nutrition, while corresponding fluids served for the generation of the foetus in the womb at conception.<sup>43</sup> Gentile too argued that the humours in the uterus were, admittedly, barely noticeable, but actually identical with the humours used for nutrition and growth.<sup>44</sup> Jacopo spoke of similarities in the character of the mutations, which were necessary for the two processes to take place. The material for generation underwent mutations in the womb, which were comparable to the mutations of food during

---

<sup>42</sup> Avicenna, *Canon* I.1,5,1 'Membra sunt corpora que ex prima humorum generantur commixtione, quemadmodum humores sunt corpora, que ex prima ciborum generantur commixtione sicut cibi sunt ex prima commixtione generati elementorum'.

<sup>43</sup> Jacopo da Forlì, *Canon* I.1,5,1 'quia ex prima commixtione humorum nutritur. igitur generatur. patet consequentia, quia eadem est materia nutricationis et generationis [...]. Vel exponitur. ex prima commixtione humorum idest ex re immediate ex humoribus commixtis generata, et ista est humiditas secunda ut in nutricatione aut sibi proportionalis ut in generatione fetus in matrice'.

<sup>44</sup> Gentile da Foligno, *Canon* I.1,5,1 'Dicendum quod loquitur de factione membrorum in utero: ibi autem non apparet materia manifestior ex qua membra fiant: nisi humores forsan tamen humores transeunt ad formas membrorum per humiditates similes humiditatibus quibus membra nutriuntur: sed iste non sunt multum manifeste: et ideo dicuntur membra primo idest immediate: ut communiter exponitur fieri ex humoribus existentibus in matrice'.

nutrition.<sup>45</sup> Both authors noted yet another resemblance between the two processes. They pointed out that an extrinsic actor would be necessary for humours to become *membra* during both nutrition and generation, as the humours would not be able to successfully mix and change by themselves.<sup>46</sup> At the very beginning of life, when *membra* were generated in the womb, sperm or the generative power would exert power over humours in order to create *membra*. During life, humours as products of food took care of the sustaining and growth of *membra*. They in their turn were forced by the *membra* themselves to mix and become part of the *membra*.

Thus, the commentators easily linked aspects of the coming-to-be of small parts of growing or full-grown *membra* with their initial coming-to-be at conception. Avicenna's definition of the concept, which so strongly focused on the generation of *membra* from other structures, certainly made way for associations with their initial generation.

### *Spermatic and sanguinary membra*

According to the medieval medical tradition, sperm and menstrual blood left their traces in the body during the whole course of life. In the *Canon*, university physicians could find a description of spermatic and sanguinary *membra*, with their origins in sperm and menstrual blood.<sup>47</sup> The *Canon*

<sup>45</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Aliter per generationem intelligit seiunctam distinctam contra nutritionem. Ista sit in matrice immediate saltem ad apparentiam nostram ex humoribus, quia non est nota nobis alia forma ad quam prius transmutetur, licet rationale sit materiam generationis recipere in matrice mutationes proportionales illis, quas recipit in nutritione'.

<sup>46</sup> Gentile da Foligno, *Canon* I.1,5,1 'poterit tenere quod quamvis quattuor humores necessario requirantur ut materia membrorum: tamen inter se nil agunt necessario requisitum as membrorum generationem: sed extrinseco agente fiunt membra. [...] sed humores non agunt et patiuntur adinvicem: immo patiuntur a membro: quod membrum sit ex eis per nutritionem: aut a spermate: quando fiunt membra per generationem [...]. Amplius ad membrorum generationem et nutritionem requiruntur quattuor humores oppositarum qualitatum adinvicem: igitur actione eorum et passione et cum hoc extrinseco agente fient membra ex illis [...]. Imaginandum igitur est quod spermate vel membro agente in humoribus ipsi etiam ad se invicem commiscuntur et confranguntur: et sit membrum'.

Jacopo da Forlì, *Canon* I.1,5,1 'Secundum dubium. Videtur quod membra non generentur ex humoribus per commixtionem sicut humores ex elementis. [...] assumptum patet quia humores in nutritione patiuntur a membro, et in generatione patiuntur a virtute generativa [...]'.

<sup>47</sup> For medieval ideas about menstruation, see Green M.H., "Flowers, Poisons, and Men: Menstruation in Medieval Western Europe", in Shail A. – Howie G. (eds.), *Menstruation. A Cultural History* (New York: 2005) 51–64.



commentators theorised on the embryological background of different *membra*, and in this way explicitly connected adult *membra* with their counterparts at conception. The two types of *membra* and their reception in learned medieval medicine will be studied here.

In principle, the division between spermatic and sanguinary body parts was a simple one. Flesh and fat were sanguinary *membra*. Practically all the other *membra simplicia*, or the *membra* consisting of one type of matter, were described as spermatic.<sup>48</sup> As Gentile da Foligno explained: spermatic *membra* were those which were hard and mostly white, like bones, cartilage, nerves, chords, ligaments, arteries, and veins, while other spermatic tissues possessed a celestial colour, like membranes and coverings.<sup>49</sup>

Spermatic *membra* were considered to be better than the flesh and fat of the sanguinary *membra*. Gentile da Foligno was most outspoken, when he stated that *membra spermatica* were all the principal, noble, intrinsic parts, like the liver, the heart, and the lungs, as well as the firm and solid extrinsic parts, like bones and nerves.<sup>50</sup> The flesh and fat of the sanguinary *membra* could be found in between all these organs and tissues. Other commentators depicted the relationship between the two parts with a comparison between nature, creating an embryo, and a painter at work.<sup>51</sup> Just as the painter would start his painting with the contours and outlines of his object, so would nature first create the spermatic *membra* of the embryo. And while the painter would only afterwards fill in the

<sup>48</sup> Gentile da Foligno, *Canon* I.1,5,1 'Considerandum quod Avicenna innuit hanc divisionem membrorum: quedam generantur ex sanguine: ut caro et adeps: quedam ex spermate: ut reliqua membra: que dicuntur spermatica ut dicitur'. Ugo Benzi, *Canon* I.1,5,1 'Dicit primo denuo dicendum esse quod membrorum quedam sunt que generantur ex spermate: quedam sunt que generantur ex sanguine. primo modo sunt omnia simplicia membra preter carnem et adipem. secundi modi sunt caro et adeps'.

<sup>49</sup> Gentile da Foligno, *Canon* I.1,5,1 'Dicamus secundo quod per membra spermatica possumus intelligere omnia membra que ad duriciem deveniunt et albedinem: saltim plurima: sicut sunt ossa: cartilagines: nervi: corde: ligamenta: panniculi: vene: et arterie: et dixi plurima: quia quedam spermatica sunt celestini coloris: ut tunicasive pellucida vuca: et secundina [...]'.  
<sup>50</sup> Gentile da Foligno, *Canon* I.1,5,1 'Dicamus tertia quod per membra spermatica possumus intelligere omnia membra principalia et nobilia intrinseca quantum ad omnem partem necessaria eis: et omnia membra extrinseca dura vel solida: sicut ossa: nervi etc. Et tunc caro epatis et cordis et splenis et pulmonis et corpus cerebri dicentur membra spermatica: carnes autem pure in musculis et carnes sensitive et carnes glandose dicentur membra carniformia [...]'.  
<sup>51</sup> The metaphor is connected to the comparison Aristotle drew when describing the function of the bones: 'For just as an artist, when he is moulding an animal out of clay or other soft substance, takes first some solid body as a basis, and round this moulds the clay, so also has nature acted in fashioning the animal body out of flesh'. Aristotles, *De partibus animalium* 654b–655a; translation Ogle W. (1882).

empty spaces in his painting with suitable colours, nature would fill in the voids of the embryo with flesh and fat at a later stage.<sup>52</sup>

When considering spermatic and sanguinary *membra* in the embryo, one might expect that masculine sperm would generate the spermatic *membra*, and female menstrual blood the sanguinary *membra*. For the sanguinary *membra*, this prediction would be correct. However, when it came to spermatic *membra*, or to the precise description of 'menstrual blood', scholastic knowledge about the subject was far more complicated. The commentators had to face three problems before making statements about the origins of spermatic and sanguinary parts. Their first problem was the existence of multiple sperms, the second the definition of *menstruum*, and the third the participation of male matter in the embryo.

Originally, scholastic medical authors knew two forms of female sperm, both tightly linked to notions of nutrition. Women secreted true sperm, which was white and well-digested, and necessary for conception, in the veins surrounding the female testicles. From there, it fell into the uterus at the time of conception.<sup>53</sup> In the medical tradition, it was a long-accepted tradition to view the true female sperm as food for the male sperm.<sup>54</sup> While the male sperm was strongest in giving form to the embryo, the female sperm was best known for its passive quality of providing matter. In the presentation of female sperm as nourishment for the male sperm, both ideas elegantly came together. Just as the *membra* forced form on digested food later in life, and the digested food served to add or restore

<sup>52</sup> Despars, *Canon* I.1,5,1 '[...] sed est apta ut coaguletur et convertatur in carnem et adipem ad implendum loca vacua circa lineationes et protractiones membrorum spermaticorum: ita quod natura facit ut pictores qui primo lineant et protrahunt imagines: postea replent aptis coloribus loca intermedia et circumstantia linearum'.

<sup>53</sup> Benzi, *Canon* I.1,5,1 '[...] et de spermate mulieris hora conceptionis'.

Gentile da Foligno, *Canon* I.1,5,1 'Alia tertia est materia in muliere: que proprie dicitur sperma mulieris: que quidem est materia alba digesta in vasis spermaticis circa testiculos mulieris: que in hora conceptionis cadit in concavum matricis: ut determinatum passivum in generatione fetus [...]'.

<sup>54</sup> Despars, *Canon* I.1,5,1 'Secunda conclusio: sperma mulieris est utile ad generationem [...]. Quarto ut nutriat virile sperma et ipsum augmentet ad id existens magis idoneum quam sanguis menstruus propter maiorem similitudinem ipsius cum spermate virili. Et harum utilitatum feminei spermatis meminit Galienus.14. de utilitate partium capitulum.11.[...] Easdem utilitates commemorat sedundo de spermate capitulum.5'. Gentile da Foligno, *Canon* I.1,5,1 '[...] particulariter autem loquendo Galienus voluit quod sperma mulieris sicut frigidius et aquosius sit quidam cibus spermate viri: ut apparet primo libro de spermate capitulum.9. et secundo libro capitulum.8. [...] Sed si subtilius consideras Galienus ibi per sperma: utrumque sperma intelligit: licet principaliter sperma viri: et vult ista spermata vere augeri: et vere nutriri scilicet ex sanguine mulieris: vocat tamen ibi sperma id quid est agens: et hoc principalius est sperma viri'.

matter to the *membra*, male sperm forced form on its food, female sperm, which gave matter and volume to the newly-formed embryo.

As the interior of the womb was not sensitive to touch, the emission of the female sperm in the proper sense would not become a source of pleasure to the woman during coitus. A second type of sperm, secreted to the outside just like masculine sperm, would take care of that.<sup>55</sup> This sperm was like saliva, and came from the mouth of the womb.<sup>56</sup> Saliva, the mouth, and sensual pleasure: Jacopo da Forlì, who gave the most complete description, constructed three parallels between the act of eating and the act of intercourse while discussing this female spermatric substance.<sup>57</sup> Thus, the relations between nutrition, generation and femininity were firmly stressed in the medical discourse of female sperm.

The two forms of female sperm were analogues of the two types of male sperm. The first type of male sperm was true sperm, necessary for procreation. It was useful, active, white and foamy, made from well-digested blood.<sup>58</sup> In the *Canon*, a second and infertile form of male sperm was also described under the name of *alguadi*. This sperm would be secreted by men before or without intercourse, just by the touch or sight of a woman.<sup>59</sup> The commentators associated neither of these sperms with food.

<sup>55</sup> Jacopo da Forlì, *Canon* I.1,5,1 'dicitur etiam de superfluitate salivali ad os matricis expulsa in muliere hora coitus, que [...] solum gratia delectationis a natura in muliere inventa. Cum enim sperma mulieris grossum utile generationi oporteat propelli in concavum matricis non percepisset multam delectationem in coitu nisi alia superfluitas fuisset per collum matricis expulsa, quod est membrum multe sensibilitatis'.

<sup>56</sup> Jacopo da Forlì, *Canon* I.1,5,1 'dicitur etiam de superfluitate salivali ad os matricis expulsa in muliere hora coitus, que non est per se utilis ad generationem, sed solum gratia delectationis a natura in muliere inventa'. Gentile da Foligno, *Canon* I.1,5,1 'unum sperma est humiditas quedam salivalis: in cuius expulsionem mulieres delectantur in coitu [...]'. Benzi, *Canon* I.1,5,1 'Et de humiditate salivali subtili quandoque in coitu a mulieribus expulsa [...]'.  
<sup>57</sup> Cadden cites Dino del Garbo's description of saliva-like sperm, taken from the *Recollecciones super libro Hyppocratis De natura fetus*, as such: 'First, it [female sperm] can enhance the pleasure of coitus in the way that saliva, which comes to the mouth when one is hungry, enhances the pleasure of food'. Cadden, *Meanings of Sex Differences* 125.

<sup>58</sup> Benzi, *Canon* I.1,5,1 'Ubi considera quod nomen spermatis apud auctores invenitur equivoce dicendum de quattuor scilicet de vero spermate prolifico maris per coitu expulso [...]'. Gentile da Foligno, *Canon* I.1,5,1 'et dicamus quod nomen hoc sperma equivocum est in viris et mulieribus: secundum Avicenna fen .20. in viris est etiam equivocum ad duo ad sperma verum prolificum [...] sperma viri utile est quoddam corpus album digestum spumum factum a virtute generativa viri ubicumque sit illa: quid sperma potest generare active [...]'.  
<sup>59</sup> Gentile da Foligno, *Canon* I.1,5,1 '[...] et ad sperma dicitur alguady: quod est quedam humiditas: que prevenit coitum: immo sine coitu exit in tactu mulieris [...]'. Benzi, *Canon* I.1,5,1 '[...] et de humiditate quedam ante coitu expulsa in mulieris contactu que vocatur ab Avicenna alguadi'. Jacopo da Forlì, *Canon* I.1,5,1 '[...] et sic dicitur de superfluitate tenui

While the concept of fourfold *sperma* already confused the relationship between *sperma* and *membra spermatica*, problems really began with the definition of *menstruum*. Female sperm in philosophical interpretations contained *menstruum* as well.<sup>60</sup> In medical circles, however, it was common to use the terms the other way round. *Menstruum* then denoted everything a woman added to the formation and feeding of the embryo, including female sperm and spermatic parts of the embryo. Yet, *menses*, or the monthly expulsions of blood from the uterus, could also be called *menstruum*.<sup>61</sup> The relations between female *sperma* and *menstruum* thus became rather complicated. Jacopo da Forlì acknowledged that authorities used the term *menstruum* now in this, now in that way, causing a great deal of confusion and contradictions.<sup>62</sup> So, while all authors agreed that women delivered the matter necessary for generation and nutrition of the embryo, it was difficult to delineate exactly what matter women added, and unclear which terms should be used.

A third problem was the question of male matter. Would male sperm act only as a forming force on female matter, without in any way becoming a material part of the embryo, as Aristotle claimed? But then the weak female sperm would lay the basis for the noble spermatic parts of the body on its own! Avicenna chose to moderate the Aristotelian views in his *Canon*, and to follow Galen more closely. He started his discussion of the involvement of male matter in the embryo with one of Aristotle's metaphors of generation. The formation of an embryo is like the process of turning milk into cheese, Avicenna said. The active principle of rennet

---

dicta alguadi in viris quandoque expulsa solo mulieris aspectu, que etiam expellitur in pueris antequam polluantur'.

<sup>60</sup> Gentile da Foligno, *Canon* I.1.5,1 'Alia materia in muliere: quam aristoteles in suis libris de generatione animalium vocat sperma est menstruum mulieris: quod communiter omni mense expellitur: [...] et hoc sperma ab aristotele sic nominatum: apud medicos communiter non dicitur sperma: quia non est id ex quo in prima generatione fit fetus [...] et hoc sperma mulieris [true female sperm] et menstruum quod omni mense expellitur: dictum sperma ab Aristotele'.

<sup>61</sup> Benzi, *Canon* I.1.5,1 'primo de sanguine per venas matricis a matrice ex earum aperitione propulso qui immo dicitur menstruus: quia de mense in mensem propellitur'.

<sup>62</sup> Jacopo da Forlì, *Canon* I.1.5,1 'Sciendum secundo hoc nomen menstruum sumi quandoque pro sanguine periodice, et secundum plurimum de mense in mensem per venas matricis expulso [...] Quandoque se extendit ad materiam generationis embrionis a muliere decisam, et sic extenditur nomen menstrui ad sanguinem attractum ad locum generationis et ad sperma muliebre quod non videtur nisi sanguis ulteriori digestionem digestus et albus. Dum igitur de menstruo auctores loquuntur, quando accipiunt pro uno quando pro alio. Et ex hoc tali possunt multe apparere contrarietates'.

forced the milk to coagulate – like male sperm gave form to female sperm. Avicenna only deviated from Aristotle's interpretation of the metaphor in his conclusion. Both milk and rennet would become part of the resulting cheese, just like male and female sperm became part of the embryo's substance.<sup>63</sup>

In the same vein, Avicenna wrote that male and female sperm together formed the spermatric *membra*, while the sanguinary *membra* were generated from blood.<sup>64</sup> One can understand his reasoning: if both male and female sperm became part of the embryo, it would be logical to assume that the two would come together in the spermatric *membra*.

The reaction of the commentators to this scheme of Avicenna was extremely varied. Two commentators refused to acknowledge Avicenna's distortion of Aristotle's opinion. Gentile da Foligno and Jacopo da Forlì clung to Aristotle's ideas and to their faith in Avicenna's wisdom alike. According to them, anyone who might think that Avicenna deviated from Aristotle here was mistaken.<sup>65</sup>

The commentators seemed to accept Avicenna's second premise, that male and female sperm formed the spermatric parts together. Yet they devoted so much effort to explaining the differences between the two types of true sperm, and between female sperm and menstrual blood, that this smokescreen diverted attention from Avicenna's original statement. For instance, after discussing eight differences between female sperm and *menstruum*, followed by three differences between the female sperms and male sperm, Gentile stated that every time he spoke about true and well-

<sup>63</sup> Avicenna, *Canon* I.1,5,1 'Sed secundum sermonem eius qui de sapientibus verificavit, de spermate masculi generatur sicut generatur caseus, de coagulo, et de spermate mulieris generatur sicut caseus generatur de lacte [...]. Et quemadmodum unumquodque duorum, coaguli videlicet et lactis est pars substantie casei qui sit ex eis, ita unumquodque duorum spermatum est pars substantie embrionis'.

<sup>64</sup> Avicenna, *Canon* I.1,5,1 'Et etiam denuo dicemus quod membrorum alia sunt que generantur ex spermate que sunt similium partium membra preter carnem et adipem. Et alia sunt que ex sanguine generantur, sicut adeps et caro. Quod enim est preter hec duo ex duobus generatur spermatibus, masculorum spermate et spermate mulierum'.

<sup>65</sup> Gentile da Foligno, *Canon* I.1,5,1 'Hic quidam mordent Avicenna quod non bene intellexerit Aristotelem quia vult quod unumquodque duorum spermatum est pars substantie embrionis [...] Nos dicamus quod Avicenna omnino sequitur Aristoteles in hac opinione [...] Jacopo da Forlì, *Canon* I.1,5,1 'Circa hec quedam insurgunt dubia. Primum, quia hec non videtur positio Aristoteli quam Avicenna in littera explicat [...]. Ad primum dicitur quod per partem substantie embrionis non intellexit Avicenna in littera partem que est proprie sumpta scilicet integram aut essentialem, sed per partem intellexit omne essentialiter concurrens ad alterius productionem, vel omnem causam ordinatam essentialiter concurrens ad productionem alterius, sicut sperma viri et mulieris ad productionem embrionis'.

digested female sperm, he used these positive epithets in relation to menstrual blood or to other female sperms, and not in relation to the superior male sperm.<sup>66</sup> Proceeding in this way, Gentile did not need to say much about the origins of the spermatic *membra*.

Ugo Benzi and Jacques Despars took a more positive stance towards Avicenna's modifications. Ugo Benzi referred to a distinction between delicate, foamy male sperm, and coarse male sperm: only the latter became part of the embryo.<sup>67</sup> Still, according to Ugo, the spermatic *membra* came from whitened *menstruum*.<sup>68</sup> Jacques Despars stayed closest to Avicenna's interpretation. Despars not only agreed with Avicenna that it was far more likely that rennet remained part of cheese,<sup>69</sup> he also vehemently argued that male sperm found a place within the embryo's substance. How else, for instance, should one explain the hereditary likeness between father and child?<sup>70</sup> Despars repeated Avicenna freely on the point of female and male sperm as the two sources of *membra spermatica*, confirming the statement with another reference to heredity. If the woman's sperm did not become part of the embryo, how else should the likeness between mother and child be explained?<sup>71</sup>

<sup>66</sup> Gentile da Foligno, *Canon* I.1,5,1 'Considerandum autem circa premissa quod semper cum dico verum sperma mulieris et bene digestum: non intelligo hoc respectu spermatis viris: quia respectu illius est incompletum: sed intelligo respectu menstrui mulieris vel respectu alterius spermatis in eis'.

<sup>67</sup> Benzi, *Canon* I.1,5,1 'Et quia super tegni diximus sperma viri solum secundum partem spumose effective concurrere ad fetus generationem. Et pars grossa est solum ut sit vehiculum spiritus ut sit materia spiritus: immo cum spiritus in membrorum substantiam non convertatur materialiter: sed solum se diffundendo per materiam ipsam transmutet'.

<sup>68</sup> Benzi, *Canon* I.1,5,1 '[...] sed immo dicuntur spermatica: quia illorum materia est sanguis menstruus in mulierum testiculis dealbatus et depuratus qui sanguis a quibusdam dicitur sperma muliebres etc'.

<sup>69</sup> Despars, *Canon* I.1,5,1 'Circa tertio. Attende quod aristoteli sententia est quod neque coagulum est pars casei neque sperma viri pars embrionis. [...] verumtamen sententia principis quod coagulum est pars casei est sensui conformior et verisimilior. Nam in constitutione casei coagulum immiscetur lacti; et nusquam apparet postquam immixtum est quod separetur immo caseus retinet aliquid odoris et saporis ex coagulo presertim si de eo multum ponatur'.

<sup>70</sup> Despars, *Canon* I.1,5,1 'Secundo nisi sperma masculi intraret substantiam fetus et fierent ex eo membra sibi proportionata: sed esset solum sicut artifex sequeretur quod calculus non generaret calculosum: neque strumosus strumosum: neque mancus mancum: sicut artifex deformis: vel monstruosus non facit imaginem deformem: vel monstruosam. Ista enim non contingunt nisi quia semen patris infectum manet infectum in substantia filii'.

<sup>71</sup> Despars, *Canon* I.1,5,1 'Secunda conclusio: sperma mulieris est utile ad generationem. Primo quidem ut cum spermate viri sit materia membrorum spermaticorum. Cuius rei signum est quod mulier podagrica vel calculosa vel monstruosa generat similem prolem'.

*Nourishment and blood*

After considering these different opinions on male sperm as embryological matter, the commentaries on the following section of the *Canon* read as a miracle of agreement. There, the physicians discussed Avicenna's passages on the nourishment of the embryo after its original formation, and apparently these remained close to their own basic ideas on the order of the world. The authors turned to menstrual blood. Nutrition, femininity, and generation were once again linked.

When the spermatic *membra* of the embryo had been formed, Avicenna said, female menstrual blood started to play its role. Menstrual blood consisted of different parts. A first part was turned into a white substance, with a nature close to that of sperm. This part of menstrual blood served as nourishment to the spermatic *membra*. Another part of menstrual blood would coagulate into flesh and fat, and fill in the gaps between the spermatic *membra*. In other words, the second part of menstrual blood formed the sanguinary *membra*, and was thus involved in generation, not in nutrition. A third part of the blood was superfluous and of no use. It remained in the womb until the baby was born.<sup>72</sup> After delivery, Avicenna indicated, the baby would be fed with milk, produced from menstrual blood.<sup>73</sup>

The commentators were eager to follow Avicenna on this scheme of female blood and nutrition. Jacques Despars described most explicitly the ongoing use of menstrual blood as nourishment before and after delivery:

Thirdly he says that after the infant has left the mother's womb, blood made by his own liver replaces this [menstrual] blood. His liver generates the blood from milk, suckled at the breast. From the milk, the same flesh and fat and parts of spermatic *membra* are generated which were generated before from menstrual blood in the maternal womb, but now through nutrition and growth.<sup>74</sup>

<sup>72</sup> Avicenna, *Canon* I.1,5,1 'Postea vero sanguis qui in tempore menstruorum a muliere separabatur sit nutrimentum. Sed alia pars eius est que in similitudinem convertitur substantie spermatis et membrorum que ex eo generantur et erit nutrimentum augmentans ipsum. Alia pars eius est que non nutrimentum sit adhuc: sed est conveniens ut coaguletur ad implenda loca membrorum primorum vacua et sit caro et adeps. et alia pars eius est superfluitas que nulli harum duarum rerum est bona et remanet usque ad horam partus quam utpote natura superfluum expellit'.

<sup>73</sup> Avicenna, *Canon* I.1,5,1 'Cumque infans parturitur sanguis quem ipsius hepar generat, huius sanguinis vices supplet et generatur ex eo quid ab eo sanguine generabatur'.

<sup>74</sup> Despars, *Canon* I.1,5,1 'Tertio dicit quod postquam infans exiverit ab utero materno sanguis quem generat epar ipsius ex lacte scilicet sucto a mamillis supplet vices huius



The mother's body nourished the child, before and after birth, through menstrual blood and its product, milk. Jacopo da Forlì showed at other points in his commentary on this chapter how logical and natural the connection between nutrition and motherhood felt. For instance, external signs of female fecundity were for him not so much signs of the ability to conceive, but signs of the ability to feed. The growth of pubic hair, the onset of menstruation, and the elevation of the breasts showed that an abundance of matter existed in the female body. The matter was useful as nourishment for the woman's *membra*, but clearly could also serve as food for the foetus, because it was for the sake of the foetus that nature brought about all these external changes. As nature should not be more solicitous for nutrition than for generation, Jacopo continued, she also pushed superfluous matter to the spermatic veins and to the woman's testicles, in order to be turned into female sperm.<sup>75</sup> Elsewhere, the author wondered why nature had chosen to feed the foetus from menstrual blood, and not simply to bring food to the foetus's stomach, food which the mother had chewed for him.<sup>76</sup> Jacopo referred to morning sickness as one reason for nature's choice in this matter: so that if the mother's stomach was so upset that no appetite was left, the child would not lack nourishment.<sup>77</sup>

Avicenna's discussion of nourishing menstrual blood brought to the fore once again the commentators' belief in the superiority of the spermatic *membra* over the sanguinary ones. A first distinction within the monthly discharges from the womb would be the one between impure and pure parts. Although menstrual blood looked filthy and putrid, the commentators stated, it still contained unpolluted and laudable parts,

---

sanguinis et generatur ex eo illud quid generabatur ex sanguine menstruo in utero materno scilicet caro et adeps partes membrorum spermaticorum per viam nutritionis et augmenti'.

<sup>75</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Ad primum respondetur et dicitur quod licet naturalis exitus menstruorum cum aliis signis pluribus apparentibus in muliere in etate pubertatis, puta elevatione mamillarum, pilositate pectinis [...] sint signa quod mulier sit fecundabilis, non tamen necessario hec signa nec aliquod precedit conceptionem, licet in pluribus antecedant. Concedendum est tamen quod sunt huiusmodi signa pro quanto sunt ostendentia iam superesse materiam, non solum pro nutrimento membrorum mulieris necessaria, sed etiam pro nutrimento foetus, propter quod natura iam materias superfluas expellit versus mamillas et partes matricis, et mamillas augmentat ut sint lactis continente et generative. Et ex hoc comprehenditur naturam pellere materiam ad vasa spermatica et testiculos superfluum convertibilem in sperma. Non enim magis sollicita videtur debere esse natura de materia nutritionis quam de materia generationis'.

<sup>76</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Tertium dubium. Per quem modum nutriatur foetus in utero ex sanguine iam dicto, et quare non ordinavit natura ad stomachum pueri transire cibum masticatum a matre, ex quo fieret ibi chylus et sanguis in hepate eiusdem'.

<sup>77</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Tertio ne cum perturbaretur aut destrueretur appetitus stomachi matris deficeret foetui nutrimentum'.

which were used for formation of the embryo and nutrition of the foetus during pregnancy.<sup>78</sup> The best of these pure parts were used for the nutrition of the spermatic *membra*, while the pure parts of a lesser quality became flesh and fat.<sup>79</sup>

It is also significant in this respect that the generation of the sanguinary *membra* received so little attention from both Avicenna and his commentators, when compared to the generation of the spermatic *membra* in an earlier stage of conception. Avicenna mentioned the generation of flesh and fat only after the nutrition of the already-created *membra spermatica*, and his commentators took little heed of this step in the formation of the embryo, which to modern eyes would seem vital. Jacopo da Forlì took the trouble of explaining that this same part of menstrual blood would serve first as matter for the generation of flesh and fat, and then as nourishment of these sanguinary *membra*. Gentile da Foligno mentioned that, during pregnancy, the time of nutrition and growth of the embryo started after the time of generation. The time of generation, he explained, could also be seen as the time of the sperms. Yet, as explained above, the *Canon* actually presented the generation of flesh and blood as starting together with the nutrition of spermatic *membra*, and therefore after spermatic generation had been completed.<sup>80</sup> Obviously, the learned doctors saw the generation of the noble and sustaining *membra spermatica*, the outlines of the embryo, as far more important than the creation of the embryo's flesh

<sup>78</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Sciendum secundo quod quantumcumque sanguis menstruus videatur putridus et corruptus, in eo tamen sunt partes aliquae non putridae nec corruptae sed pure et laudabiles ab hepate et natura pueri rectificabiles, ex quibus aliquae transeunt in materiam nutritionis. aliquae vero opportuno tempore transeunt in lac. partes autem penitus impure aut non rectificabiles reservantur ad horam partus et simul cum foetu expelluntur cum infra videbitur'. Benzi, *Canon* I.1,5,1 'tertio de sanguine que tempore pregnationis malus et superfluous detinetur in partu pellendus. quarto de illo sanguine que in muliere ad mammillas: ut in lac convertatur transmittitur'. Gentile da Foligno, *Canon* I.1,5,1 'Et notandum quod [...] huic sanguini solum tres partes assignantur scilicet unam ex qua fetus nutritur: et aliam que sit lac: et iste sunt meliores partes illius sanguinis: et tertiam que reservatur usque ad horam partus [...]'].

<sup>79</sup> Gentile da Foligno, *Canon* I.1,5,1 'Considerandum quod quatuor partes assignantur sanguini menstruo: unam que dealbatur ut sit nutrimentum conveniens membrorum spermaticorum iam formarum: et hoc est quod Avicenna dicit. [...] quia pars sanguinis menstrui que periodico motu evacuabatur fit nutrimentum hoc modo: quia una pars eius scilicet melior convertitur in similitudinem substantie spermatis: aliam partem huius menstrui Avicenna ponit converti in carnem et adipem predictos secundum modum qui dicitur'.

<sup>80</sup> Gentile da Foligno, *Canon* I.1,5,1 'Aliud est tempus nutritionis: et augmentationis: quod incipit post tempus generationis scilicet spermaticorum: et tunc simul incipit generatio carnis et adipis'.

and blood, which were supposed only to fill in the empty places between the lines.<sup>81</sup>

*Spermatic and sanguinary membra later in life*

During the whole course of life of the human, his body would remind him of the low materials out of which it was initially created. Not for nothing did Jacques Despars exclaim:

O miraculous wisdom and goodness of God almighty, who joins such filthy matters together, and creates such useful bodies! O poor mortal with your fragile nature, why are you proud? Consider your origins!<sup>82</sup>

Sperm and menstrual blood remained visible in the physical structures of man. Spermatic *membra* still were the hard, white, and sustaining parts of the body, while the sanguinary *membra* kept their softness and usefulness in filling up the spaces between the spermatic parts.

While these differences in appearance and firmness had already been clear in the embryo, one other important distinction between spermatic and sanguinary *membra* came to the fore only after the period in the womb. The two types of tissue differed markedly in their reaction to injury, or the break in continuity, as it was called in medieval medicine. Avicenna described how the spermatic *membra* would in principle not be restored after injury. If their continuity was broken, no new tissue would be created to fill the gap, and to reconnect the two ends. He allowed exceptions to this general rule: in the bodies of children and youngsters, small lesions in relatively unimportant structures could be filled.<sup>83</sup> If, however, the sanguinary *membra* were to be damaged, new and similar material would be

---

<sup>81</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Declarat quo ad secundum partem, in quam dividitur sanguis. Et dicit quod illa alia pars sanguinis que adhuc non sit nutrimentum alicuius membri est conveniens ad hoc ut fiat materia generationis carnis adipis, et pinguedinis, que debent replere loca vacua primorum membrorum idest vacuitates cadentes inter prima membra idest spermatica'.

<sup>82</sup> Despars, *Canon* I.1,5,1 'O mirabilis sapientia et bonitas omnipotentis dei qui tam fedas materias tantis applicas commodis. O fragilis nature pauper homo cur superbis. Considera primordia tua'.

<sup>83</sup> Avicenna, *Canon* I.1,5,1 'Membra autem que ex spermate sunt creata cum solutionem continuitatis patiuntur certa continuitate non restaurantur nisi pauca ex eis: et in paucis habitudinibus et in etate pueritie: sicut ossa et rami venarum parvi: non enim magni neque arteriarum. Cum enim aliqua eorum pars seiungitur nihil locus eius nascitur. Et hec quidem sunt sicut ossa et nervi'.

created to make up for the loss, and continuity would be restored. The *Canon* used the word *renascere*, to be reborn, to describe the process.<sup>84</sup>

The different outcomes of injury experienced by the two types of *membra* gave rise to new thoughts about the relation between generation and nutrition. For instance, when Jacques Despars wondered if the regenerated parts of sanguinary *membra* would really be one and the same as the parts which had been lost because of the injury, he mused on Socrates' identity and the effect of nutrition. Through nutrition, Socrates' matter would change, but as his soul remained untouched, he himself kept the same numerical form. The same would count for regenerated parts of flesh, the matter for which had also been provided by food.<sup>85</sup>

In this context, the commentators often referred to Aristotle's opinion that the material for nutrition was the same as the material for generation. If sperm was made of nourishment, why should it be impossible to regenerate the spermatic *membra*?<sup>86</sup> After all, it seemed certain that the spermatic *membra* received sustenance during the whole course of life, and that they grew during childhood. Taddeo Alderotti had provided a solution for this problem, which was repeated by Jacopo da Forlì. The restorative power of the body could only function if its matter was proportionate to that which had been lost. For the sanguinary parts, it was easy to find matching matter. They were so soft and permeable that all matter from conception had been lost during the processes of nutrition and growth after birth. Because of that, they could without difficulty be regenerated from food. The soft parts needed to be sustained by hard, spermatic *membra*. These *membra* always retained some of the original matter of the embryo deep in their core. Therefore, it was impossible to

---

<sup>84</sup> Avicenna, *Canon* I.1,5,1 'Illa vero que ex sanguine sunt creata renascuntur post perditionem suam et continuantur tali substantia qualis sunt ipsa sicut caro'.

<sup>85</sup> Despars, *Canon* I.1,5,1 'Secundo ex hoc quod forma substantialis scilicet rationalis anima est eadem in renata que fuit in deperdita: sicut ergo Socrates materialiter mutatus per viam nutritionis assidue manet idem numero tota vita quia anima eius est eadem ita videtur hic'.

<sup>86</sup> Despars, *Canon* I.1,5,1 'Queritur utrum membra spermatice soluta ipsorum continuitate possint consolidari et deperdita restaurari. Arguitur quod sic principium efficiens membrorum spermatice et ipsorum materia salve manent in corpore [...]. Assumptum probatur. Primo de efficienti principio: quia in corpore est virtus restaurativa partium deperditarum in omnibus membra faciens de nutrimento partem membri. Alioquin non nutrentur omnia corporis membra. Est etiam materia ad restaurationem deperditorum idonea. Nam cum sperma sit superfluitas utilis alimenti ultimi ut ait Aristoteles primo de generatione animalium capitulum .18. Et alimentum ultimum sit inventum in toto corpore: sperma etiam reperietur in toto corpore'.

find entirely similar matter after birth, and the spermatic *membra* could not be regenerated.<sup>87</sup>

Another explanation came from Pietro d'Abano, and was cited by Ugo Benzi and Jacopo da Forlì. Pietro gave four reasons to explain why spermatic *membra* could not be restored after birth. Nutrition was an important notion in three of them, which will be discussed here. For Pietro's first argument, he used the notion of the *virtutes* or soul powers. *Virtutes* performed functions of the soul, and so the nutritive soul possessed generative and nutritive powers. As the spermatic parts were generated in the very first stage of foetal life, they needed the generative power for their formation, which was still active then. The generative power left the body when the foetus was completely formed, and because of this it was impossible to recreate the *membra* it created. Sanguinary *membra* were formed in a later stage by the nutritive power. This power remained active in the body after birth, so it could be employed to restore lost flesh and fat. A second reason focused on the availability of matter for the restoration. Sperm or sperm-like matter was not available any more after birth, while blood, the nourishment of sanguinary *membra*, abounded.<sup>88</sup> Thirdly, spermatic *membra* were very hard, so that food and the digestive humours needed to be thoroughly transformed before they came to resemble these rigid structures, making it difficult to replace them.<sup>89</sup>

---

<sup>87</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Aliter dixit Thadeus quod causa propter quam pars membri generati ex sanguine potest regenerari, non autem membri spermatici est, quia virtus restaurativa invenit in corpore materiam proportionatam carni ex qua potest regenerari caro. Non autem invenit in corpore materiam proportionatam ossi aut alteri spermatico. et causa est quia in carne non remansit de antiqua materia ex qua primo fuit genita caro, sed tota fluxit antiqua et sustentantur tantummodo super nova materia, unde sanguis noviter genitus ex illi carni proportionatus. Expediebat enim corpori animalis ad salvandas actiones suas aliquas eius partes esse molles faciles etiam transmurabiles, sed pro fundamento harum partium mollium oportuit esse in eo partes spermaticas duras, in quibus semper quamdiu vivit animal remanet aliquid de antiqua materia ex qua prima genita sunt, cui non est proportionalis aliqua materia in corpore reperta: et ideo cum illa antiqua materia solvitur non restauratur: et similiter cum deperditur a multo fortiori'.

<sup>88</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Ad primum istorum. Dicit Conciliator [...] cuius causam dicit esse multiplicem. Prima est absentia virtutis informative que evanescit formato foetu, ut dicit ostensum esse differentia .43. Secunda est defectus materie spermaticae per quam stabat membri unitas. [...] et propter oppositas causas membra ex sanguine generata soluta vel scissa possunt restaurari. Primo quia non deficit materia. Secundo nec virtus, quia illa est virtus nutritiva carnis et carnosorum membrorum [...]'.

<sup>89</sup> Benzi, *Canon* I.1,5,1 'Conciliator enim differentia tertia annexo quarto ponit causas. [...] quarta est duricies membri: unde nutrimentum multa indiget transmutatione antequam in membri substantiam convertatur [...]'.

That sanguinary *membra* could regenerate, and spermatic *membra* could not, seems to have caused some uneasiness about the supposed superiority of the spermatic structures in the body. Suddenly, the sanguinary *membra* could do something the spermatic *membra* could not. How was this to be explained? The uncertainty gave rise to expositions about imperfect animals, which were able to regenerate whole parts of their body. Lobsters, for instance, could acquire a complete new claw after losing one, and serpents regenerated their tail if it had been cut off, not to mention the ability of plants to redevelop new branches and leaves.<sup>90</sup> Jacopo da Forlì once again had recourse to Pietro d'Abano to explain this phenomenon. When nature made the perfect animals – man being the most perfect animal possible – she tried with all her might to make them as good as possible, right from the beginning of their life. Nature considered that perfect animals would live longest if their parts were complete, strong, and well aligned from conception onwards. She was a lot less careful during the creation of imperfect animals, but made up for that by leaving some extra matter in their bodies, which they could use to overcome injuries and accidents. This solution might seem speculative, Jacopo added, but according to him it made good sense.<sup>91</sup>

The speculative message about the hierarchy between spermatic and sanguinary *membra* seems clear. The spermatic *membra* were the perfect ones, as they were created from one piece in the embryo, and therefore could not be restored later in life. Sanguinary *membra* were not that carefully put together, and in turn retained the capacity to regenerate.

---

<sup>90</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Item non minorem debet habere natura sollicitudinem de animalibus perfectis quam de imperfectis, sed ad salutem imperfectorum post eorum generationem ex semine relinquit natura in eorum membris virtutem generativam eorum post eorum deperditionem, ut in cancris, in quibus abscissis pedibus regenerantur, et et in lacertis serpentibus abscissis caudis regenerantur [...]. Et simile argumentum potest adduci de plantis in quibus partes aliquae abscisse regenerantur'.

<sup>91</sup> Jacopo da Forlì, *Canon* I.1,5,1 'Conciliator vere dicit quod natura in productione animalis perfecti totum suum posse facit ut perficiat a principio et non ita operatur in productione imperfecti. Natura enim considerans quod perfecta possint multo tempore permanere si partes haberent perfectas a principio et completas et fortes et bene continuatas ipsas a principio tales produxit. Sed imperfecta quantumcumque a principio producta integre non possunt permanere diu, ideo decrevit in animalibus imperfectis in principio non expendere totum suum posse, sed aliam materiam apud se retinet, ex qua insurgentibus defectibus et occasionibus possit succurrere. Et hec solutio licet videatur rhetorica, posset tamen reduci ad sanum intellectum'.

### Conclusion

Late medieval learned physicians discussed similar themes concerning the formation of sanguinary and spermatic *membra* in the embryo, while commenting on Avicenna's *Canon*. Spermatic *membra* were formed first, from a fusion of female and male sperm. They were noble, hard, white, and sustained the body. The formation of sanguinary *membra* out of menstrual blood did not receive that much attention. Sanguinary *membra* comprised all the flesh and fat located in between the spermatic *membra*, and they were soft. The spermatic *membra* could not be regenerated, because they contained an inimitable trace of the original sperm through which the embryo had been conceived. Sanguinary *membra* came from nurturing blood, which was still present in a grown body, and therefore could be restored after injury.

Even more dichotomies than noble-ignoble, hard-soft, skeleton-filling, and irreplaceable-replaceable can be found in the expositions on the spermatic and sanguinary *membra*. In the medieval commentaries, the formation of spermatic and sanguinary *membra*, female, blood, food, and inferiority were firmly linked to one another, and opposed to male, sperm, formation, and superiority. From a more traditional investigation of Aristotelian embryology, namely as an isolated strand of physiology, the series of dichotomies would be quite familiar. Two things, however, are new. Because of the specific nature of the case study, the aspect of replication is involved. Secondly, usually 'matter' would be mentioned as the opposite of 'form', but in this case study 'food' has entered the female series, and replaced 'matter'. The female contribution to generation could be formulated concisely as that of offering nourishment: to the male semen, to the embryo, and to the newborn. The new series of dichotomies seems to illustrate the value of following contemporary associations, like the association of generation with nutrition, when studying the history of science.

The late medieval authors clearly showed just how self-evident these connections felt. When the *Canon*, their mother text, gave statements which seemed to go against the usual associations, the commentators provided a wide variety of arguments, which were often unclear. Yet if the *Canon* stayed in line with their expectations, their arguments were fluent, logical, and unanimous. Their obvious preference for arguments according to the standard dichotomy suggests that these associations reflected broader cultural preferences of their age.



The learned medical authors equated the female principle in conception, female sperm or menstrual blood, with food. The bonds between femininity and food in the Middle Ages became clear in the realm of religion as well. Caroline Walker Bynum has given a highly nuanced account of the ways in which food practices were specific to female devotion in Western Christianity. Feeding others and denying food for oneself were important aspects of the ways in which medieval women honoured God. Charitable women would go out and bring food to the poor, food which they denied to themselves, while charitable men would typically give money.<sup>92</sup> Another form of female fasting could be part of eucharistic devotion. Women, more than men, craved to receive the body of Christ, and eagerly cleansed their bodies through fasting beforehand. Eucharistic miracles were far more common for female than for male saints and mystics.<sup>93</sup> Walker Bynum also suggests that fasting, charity, and ecstasy could be means for wives as well as daughters to escape the role of food preparer or nurturer.<sup>94</sup> Thus, through deviant food practices, medieval women could actually flee the responsibilities society expected them to take – responsibilities shaped by food and fertility.

The story of male sperm as the precious and irreplaceable core and foundation of the human body was also sustained by a firm cultural basis in the Middle Ages. In a theological context, male sperm was sometimes seen as providing the core of the human being, necessary for resurrection. Peter Lombard's (ca. 1100–† 1160) account, for instance, had proved highly influential. Lombard explained the biblical fact that the whole of mankind inherited Adam's sin by pointing out that the substance of every human being was in Adam's loins when he sinned. The human substances grew miraculously by multiplying in themselves, without the addition of any extraneous material like food. Furthermore, during the process of generation, the substance which originally resided in Adam's loins would be passed from one individual to the next, together with original sin. This material was essential for conception, and food would not influence it in any way.<sup>95</sup> Thus, Lombard's account firmly stressed the superiority of

<sup>92</sup> Walker Bynum, *Holy Feast and Holy Fast* 88.

<sup>93</sup> Walker Bynum, *Holy Feast and Holy Fast* 77.

<sup>94</sup> Walker Bynum, *Holy Feast and Holy Fast* 220–227.

<sup>95</sup> Reynolds, *Food and the Body* 1–2. The passage can be found in Peter Lombard's work *Sententiae*, vol. II, 30, 14–15. Cf. also Walker Bynum C., *The Resurrection of the Body in Western Christianity, 200–1336* (New York: 1995) 124–126.

formation over nutrition, and presented male sperm as the true matter of the human body.

In the thirteenth century, theologians could no longer accept Lombard's miraculous account of sperm and food, and tried to move more into line with contemporary science. They started using concepts of radical moisture or *humidum radicale* and nutrimental moisture or *humidum nutrimentale*. Radical moisture was supposed to be the root of the body, infused into the embryo at the moment of conception through the semen, and providing the body's stability. Nutrimental moisture came from food, as the name indicated, and was built into the body in order to replace the lost radical moisture. When all radical moisture was used up, the human being died.<sup>96</sup> Again, sperm was presented as opposite to food and as a unique, superior substance, sustaining the existence of the human body. Food could not truly replace the spermatic substance, as it merely added some volume and fuel. The science of embryology thus contained images and meanings which connected generation, nutrition, and growth. With this science, authors went far beyond a simple account of the growing foetus. They constructed powerful images of male superiority and female inferiority.

---

<sup>96</sup> Reynolds' book *Food and the Body* deals with exactly this part of intellectual history, and treats the main thirteenth-century theological accounts in great detail. In the same year, Joseph Ziegler published an article on the same subject matter: Ziegler J., "Ut dicunt medici: Medical Knowledge and Theological Debates in the Second Half of the Thirteenth Century", *Bulletin of the History of Medicine* 73 (1999) 208–237. For *humidum radicale*, see also McVaugh M.R., "The 'Humidum Radicale' in Thirteenth-Century Medicine", *Traditio* 30 (1974) 259–283.

*Selective bibliography*

- ARISTOTLE, *De anima*: tr. Smith J.A. (1931), *On the Soul*, in *The Complete Works of Aristotle*. Electronic edition, Bollingen Series LXXI 2, Vol. 1.
- , *De generatione animalium*: tr. Platt A. (1912), *On the Generation of Animals*, in *The Complete Works of Aristotle*. Electronic edition, Bollingen Series LXXI 2, Vol. 1.
- , *De generatione et corruptione*: tr. Joachim H.H. (1930), *Generation and Corruption, The Complete Works of Aristotle. Electronic Edition, BOLLINGEN SERIES LXXI 2. Volume 1*.
- AVICENNA, *Liber canonis* (Hildesheim: 1964; reprint of Venice, Paganus de Paganinis: 1507).
- BENZI UGO, *Expositio Ugonis Senensis super primo Canonis Avicenne cum questionibus eiusdem* (Venice, Opus impressum mandato et expensis Octaviani Scoti, Bonetus Locatellus: 1498).
- CADDEN J., *Meanings of Sex Difference in the Middle Ages. Medicine, Science and Culture* (Cambridge: 1993).
- DUNSTAN G.R. (ed.), *The Human Embryo. Aristotle and the Arabic and European Traditions* (Exeter: 1990).
- GENTILE DA FOLIGNO, *Hic merito inscribi potens vite liber corporalis Abohali Abynsцени canonis libros quinque duplici fere per totum commento munitos nuperque translatos [...] doctores circa textum positi ut locis suis apparebit hi sunt: Gentilis de Fulgineo [et alii]* (Venice, Bernardinus Benalius: 1503).
- GREEN M.H., "Flowers, Poisons, and Men: Menstruation in Medieval Western Europe", in Shail A. – Howie G. (eds.), *Menstruation. A Cultural History* (New York: 2005) 51–64.
- HEWSON M.A., *Giles of Rome and the Medieval Theory of Conception* (London: 1975).
- JACOPO DA FORLÌ, *Expositio et quaestiones in primum Canonem Avicennae* (Venice, Giunta: 1547).
- LUGT M. VAN DER, *Le ver, le démon et la vierge. Les théories médiévales de la génération extraordinaire* (Paris: 2004).
- MARTORELLI VICO R., *Medicina e filosofia. Per una storia dell'embriologia medievale nel XIII e XIV secolo* (Naples: 2002).
- REYNOLDS P.L., *Food and the Body. Some Peculiar Questions in High Medieval Theology* (Leiden: 1999).
- SIRAISSI N.G., *Avicenna in Renaissance Italy. The Canon and Medical Teaching in Italian Universities after 1500* (Princeton NJ: 1987).
- ZIEGLER J., "The Scientific Context of Dante's Embryology", in Barnes J.C. – Petrie J. (eds.), *Dante and the Human Body. Eight Essays* (Dublin: 2007) 61–88.

## THE MUSIC OF THE PULSE IN MARSILIO FICINO'S *TIMAEUS* COMMENTARY

Jacomien Prins

### *Summary\**

Marsilio Ficino (1433–1499) dedicated part of his commentary on the *Timaeus* to Plato's ideas about human physiology. With few other means of diagnosis at his disposal, Ficino, as a musical healer, developed considerable sensitivity to minute variations of pulse, because they could indicate various types of emotion and disease. This paper aims to answer two central questions: why does Ficino describe hearing in the way he does and how is it connected with bodily fluids? I aim to show how Ficino's account of human physiology is strongly motivated by his interest in healing and spiritual growth. The paper engages with the traditional problems of how perception brings about changes in the perceiver, and how humours are involved in these. It argues that, although Ficino mainly seems to follow the medical tradition, he represented the interaction of hearing and humours in such a way that it offered new theoretical possibilities for music therapy.

### *Introduction*

Up to and during the Renaissance, the belief that music is inherent in the beating of the pulse was widely held by scholars in the discipline of physiology.<sup>1</sup> In the texts on music and medicine by the Italian Renaissance philosopher Marsilio Ficino (1433–1499) explicit statements of this belief, and of the associated ideas that music is also present in the emotions, the humours and in other bodily rhythms, are widespread. For Ficino, the idea of the music of the pulse was only one specific expression of the more general notion that musical harmonies are inherent in the human as well as in the cosmic body and soul. The supposed links between music and

---

\* I would like to thank Prof. Helen King and Dr Richard Ashdowne for their help with my English. Of course, I bear responsibility for any errors which remain in the text.

<sup>1</sup> The main source of inspiration for this article has been Siraisi N., "The Music of Pulse in the Writings of Italian Academic Physicians (Fourteenth and Fifteenth Centuries)", *Speculum* 50 (1975) 689–710.

human physiology and psychology were of interest for Ficino not only as a philosopher and musician, but also as a physician. Like many other philosophers, doctors, music theorists and musicians working in North Italy during the fifteenth century, Ficino provided his readers with detailed information on the influence of music on physical as well as spiritual well-being. His account of the nature of the music of the pulse, seen as part of an all-inclusive philosophy of *musica mundana* (cosmic harmony), represents a largely continuous tradition.<sup>2</sup> His views not only throw light on the concept of the harmony of the pulse itself, and hence on one aspect of early Renaissance treatment of the ancient theme of *musica humana* (music of the human soul and body), but they also illustrate something of the nature of the actual application in medical practice of the venerable tradition of linking medicine with philosophy and with the art of music.<sup>3</sup> For Ficino, as an academic writer on physiology, health, healing, and spiritual growth, the value of a profound knowledge of the science and the practice of music for the understanding of the pulse became one of a set of significant illustrations of the importance of an education in liberal arts for physicians. The following discussion of Ficino's beliefs regarding the music of the pulse aims to show the extent to which this particular topic functioned as a key concept in his ideas about human physiology and medicine.

This paper will outline the physiological bases for music therapy in Ficino's *Timaeus* commentary, and then explore how his theoretical ideas about human physiology were used in his musico-therapeutical practice.<sup>4</sup> In addition, I will try to answer the question of how far Ficino's translation and study of the account of human physiology, health and healing in Plato's *Timaeus* – which, thanks to his efforts, became accessible again in the West – changed the traditional Aristotelian and Galenic views of

---

<sup>2</sup> For a detailed discussion of this topic, see the first two chapters of Prins J.W., *Echoes of an Invisible World. Marsilio Ficino and Francesco Patrizi on Cosmic Order and Music Theory* (Alblasserdam: 2009) 15–142.

<sup>3</sup> For the way in which this tradition was institutionalised in the very existence of the faculties of arts and medicine of the Italian universities, see Park K., *Doctors and Medicine in Early Renaissance Florence* (Princeton: 1985) 198–209.

<sup>4</sup> For the revival of the *Timaeus* in the context of natural philosophy in the fifteenth century in Italy, see Hankins J., *Plato in the Italian Renaissance* (Leiden: 1990), esp. 267–359; and idem, “The Study of the *Timaeus* in Early Renaissance Italy”, in Grafton A. – Siraisi N. (eds.), *Natural Particulars. Nature and the Disciplines in Renaissance Europe* (Cambridge, MA etc.: 1999) 77–95.

human physiology, in particular of the relationship between the sense of hearing, blood 'circulation' and the emotions.<sup>5</sup>

*The harmony of the human body and soul and the music of the pulse*

Ficino's intellectual interests as a musical healer, as expressed in his different texts on the topic, were largely shaped by his training in the traditional theory and practice of the disciplines of music and medicine.<sup>6</sup> Ficino, for example, studied Galen with deep interest and used this knowledge in his explanation of physiological and medical subjects in Plato's *Timaeus*.<sup>7</sup>

Already for a long time I was convinced by the very powerful causes [of disease], about which I read in the work of the Platonist Galen, and some time ago my opinion was confirmed by the famous physician Georgius Cyprius. For he found me, because during these days he visited our house often in order to cure my mother, reading about these topics, and he connected in a miraculous way the mind of Galen with the mind of Plato.<sup>8</sup>

With only a few other means of diagnosis at his disposal, Ficino, in a quite traditional way, developed considerable sensitivity to minute variations of the duration and intensity of the pulse, because he believed that they could indicate various types of emotion and disease. A patient had fever whenever his pulse became more frequent or more forceful. Until the fifteenth century this was seen as a symptom of increased internal heat, which was associated with the element of fire. In contrast, if the pulse lost some of its high frequency or forcefulness, this was interpreted as an alleviation of fever or as a symptom of another disease. Ficino, as the result of his

<sup>5</sup> For an introduction into Plato's view on physiology and medicine in the *Timaeus*, see Nutton V., *Ancient Medicine* (London: 2004) 115–118.

<sup>6</sup> For Ficino's training, see Kristeller P.O., "The Scholastic Background of Marsilio Ficino with an Edition of Unpublished Texts" ['De Sono'], *Traditio. Studies in Ancient and Medieval History* (1944) 257–318.

<sup>7</sup> For Ficino's use of Galen's *De Placitis*, see Nutton V., "De Placitis Hippocratis et Platonis in the Renaissance", in Manuli P. – Vegetti M. (eds.), *Le Opera Psicologiche di Galeno* (Naples: 1988) 292–293.

<sup>8</sup> Ficino Marsilio, *Compendium in Timaeum* (hereafter abbreviated as *CiT*), Cap. XXXXV, 1465 (page number in the *Opera Omnia*, 1576), fol. 79 verso (page number in the 1496 edition, which is used in this article) 'Quales esse potissimum rationes, quas apud Galenum Platonium legi, iamdiu existimavi, ac nuper a Georgio Cyprio insigni medico sum in sententia confirmatus. Hic enim his diebus cum ad me curandae matris meae gratia frequenter accederet, meque reperiret haec ipsa legentem miro quodam ordine Galeni mentem cum Platonica mente coniunxit'.

confidence in the belief that the frequency of the pulse could be measured very precisely and was a reliable symptom, compared the pulse of his patient with the natural pulse corresponding to each age [Fig. 1].<sup>9</sup>

The different pulses of man were embedded in a fourfold system, in which the number four (1, 2, 3, 4) was supposed to symbolise the elements, the humours, the temperaments, the seasons of the year, and the ages of man (infancy, youth, manhood, old age).<sup>10</sup> When a trained doctor held a patient's wrist, he would compare the number of pulse-beats occurring during a set period with the natural and healthy number of pulse-beats for the patient in question and, if the pulse was more or less frequent than the norm, this indicated that he had a fever or another physical or mental disorder.

As in the human body, the pulse in music is also used to indicate the basic beat of a piece of music. The pulse is not necessarily the fastest or the slowest component of the *rhythm* but the one that is perceived as basic. The pulse has a regular *periodicity*, consisting of a series of identical short-duration *stimuli*. The pulse, therefore, depends upon repetition. The *tempo* of a piece of music is the speed of the pulse. For Ficino, a pulse which became too fast would become a drone, while one that became too slow would be perceived as unconnected sounds. 'Musical' pulses were generally specified by him as 'well-tempered', which probably means that they were somewhere in the range of 40 to 240 beats per minute.<sup>11</sup> Ficino, as a musical healer, used music to temper the pulse of a patient: as an 'antidote' he used fast music to speed up a pulse, and slow music to slow it down.

In his ideas on the interrelatedness of musical rhythms, bodily movements and spiritual and emotional life, Ficino was drawing upon traditions stretching back to classical Antiquity in the disciplines of both music and medicine. In Antiquity and the Middle Ages there were two theoretical bases for the practice of musical therapy, which may be termed as the

---

<sup>9</sup> In ancient and medieval medicine, instruments such as water-clocks and hour-glasses were used for measurements, but to my knowledge there is no evidence left of Ficino's instrument of measurement. For the pulse as a diagnostic aid in ancient times, see Nutton, *Ancient Medicine* 126–127, 237–238, 345 n 29.

<sup>10</sup> Plato, *Timaeus* 35b–36b. For a detailed explanation of this system, see Cornford F.M., *Plato's Cosmology* (London: 1937) 66–74 esp. 70.

<sup>11</sup> For an introduction into the history of the relationship between humoral medicine, pulse and music, see Kümmel W.F., "Der Puls und das Problem der Zeitmessung in der Geschichte der Medizin", *Medizinhistorisches Journal* 9, 1974, 1–22; and idem, *Musik und Medizin. Ihre Wechselbeziehungen in Theorie und Praxis von 800 bis 1800* (Freiburg im Breisgau: 1977) esp. ch. 1, "Puls und Musik", 23–62.



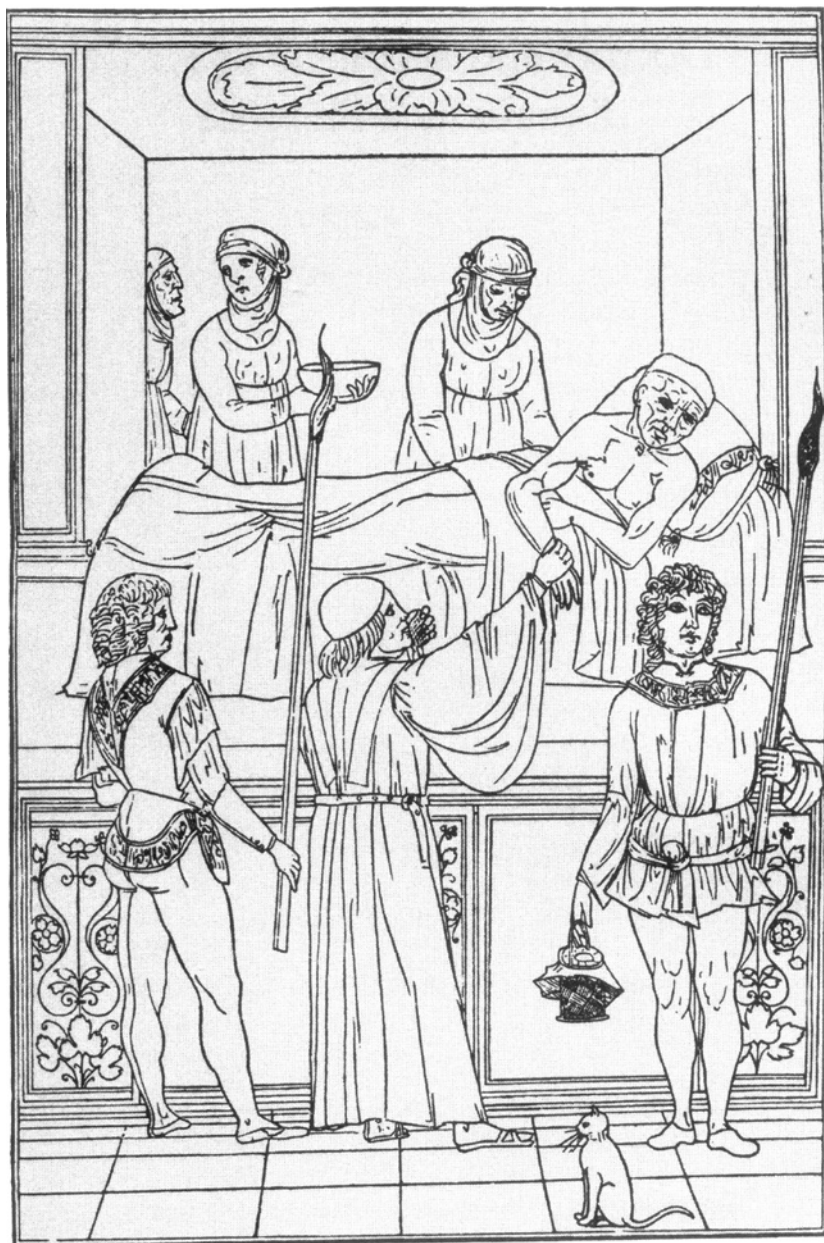


Fig. 1. Physician taking the pulse of a plague victim. Ioannis de Ketham, *Fasciculus di Medicina Vulgare* (Venice, 1493). Frontispiece.

'ethical' and the 'astrological' respectively.<sup>12</sup> The first was based on the doctrine of ethos and sprang from the observation that music affected the emotions, and therefore – according to Plato's *Timaeus* 47b–d – exercised a direct influence over the state of the soul and indirectly also over the body. The best-known Christian illustration of this was in the famous biblical story of the curative power of David's harp on the madness of King Saul, which Ficino mentioned in one of his letters.<sup>13</sup> Even though no detailed explanation was given of the way in which music supposedly influenced man, Ficino, following tradition, firmly believed that man's soul was essentially harmonious in nature. As a consequence, he was convinced that music could directly influence man's soul, spirit and emotions, and through them also bodily rhythms. In order to rediscover the knowledge of the magical curative power of music, which was still known by King David as well as by such Greek wise men as Orpheus, Pythagoras and Plato, Ficino studied the Greek musical modes which were supposed to express different well-defined emotions. This is reflected in his texts, which are full of references to the playing of a particular musical mode in order to induce a particular effect on man's emotions or physical constitution.

Ficino's claim that music had curative powers was based upon a combined ethical-astrological theoretical base. The physiological belief that both musical consonance and musical numerical proportions were in some way to be found in the pulse is substantiated by it. In his practice as a musical healer, he used his musico-theoretical knowledge, first of all, to diagnose a patient's condition by taking his pulse. His musical background thus functioned as a useful tool in analysing a very detailed kind of information on a patient's health, which was supposed to be encoded in the rhythm of his pulse. Just as an astrologer was supposed to be able to gather detailed information from someone's horoscope, a musical healer could 'hear' someone's mental as well as physical condition in his pulse. In his *Platonic Theology* Ficino cites a well-known illustration of musical pulse-reading:

---

<sup>12</sup> Cf. Burnett C., "‘Spiritual Medicine’: Music and Healing in Islam and its Influence in Western Medicine", in Horden P. (ed.), *Music as Medicine. The History of Music Therapy since Antiquity* (Aldershot etc.: 2000) 85.

<sup>13</sup> For Ficino's quotation of 1 *Samuel* 16: 14–23, see Letter 92 "De Musica" in Ficino, *Opera Omnia*, vol. II, 651 (for an English translation of this letter, see Ficino, "On Music" in *The Letters of Marsilio Ficino* 1 (translated from the Latin by members of the Language Department of the School of Economic Science, London (London: 1975–) 141–144).

Four emotions accompany the fantasy: desire, pleasure, fear, and pain. When they are at their most intense, they immediately and totally affect someone's own body and even sometimes another's. What frenzied ardour the desire for revenge stirs up in the heart or the desire for pleasure in the liver, yea in the pulse too! It was by changes in his pulse that the doctor Erasistratus<sup>14</sup> knew that Antiochus had been seized with love of Stratonice.<sup>15</sup>

Ficino clearly endorsed the traditional notion that the duration and intensity of heartbeats corresponded to particular, identifiable musical proportions. So, to detect the secrets of the heart in the rhythm of a pulse, a physician needed a profound musical training.

In addition to diagnostic practices, theoretical as well as practical knowledge of music could also be used in the actual practice of healing. The best-known illustration of this was a story told about the Arabic scholar al-Kindi (ca. 801–ca. 873), who deeply influenced Marsilio's thought on the subject.<sup>16</sup> His follower Ibn al-Qifti (1172–1248) reported of his master that one of his patients who suffered from a stroke was cured by music: after al-Kindi had diagnosed the illness on basis of the pulse of the patient, he summoned four lute-players, who subsequently played their music for a long time to let the patient regain his strength. It worked, of course, and after the long musico-therapeutical session al-Kindi took the pulse of the patient again. Not only had he by then regained a regular musical pulse, but he also started to move again and his consciousness had been fully restored.<sup>17</sup> It is precisely this musico-magical dimension of physiology and medicine that Ficino intended to revive, after it had been almost completely lost due to scholastics who concentrated too much on the human body at the expense of the soul.

<sup>14</sup> Plutarchus, *Demetrius* 38.3–4. Ficino probably knew the story through Leonardi Bruni's *Novella di Antioco, Re di Siria* (also known under the title *Stratonica*), a popular novel of the fifteenth century. The text is in Locella G., *Novelle Italiane di Quaranta Autori* (Leipzig: 1879) 238–242. For Erasistratus' place in the history of Greek medicine, see Nutton, *Ancient Medicine* 133–139.

<sup>15</sup> Ficino Marsilio, *Theologia Platonica* XIII,I,1 'Phantasiam quatuor sequuntur affectus: appetitus, voluptas, metus ac dolor. Hi omnes quando vehementissimi sunt, subito corpus proprium omnino, nonnumquam etiam alienum afficiunt. Quantos ardores vel cupiditas vindictae ciet in corde vel libido voluptatis in iecore, immo et in pulsu! Ex cuius mutatione cognovit medicus Erasistratus Antiochum esse amore Stratonicae captum' [English translation – with a small adjustment – by M.J.B. Allen, *Platonic Theology* 4, XIII,I,1, 110–111].

<sup>16</sup> For al-Kindi's influence on Ficino, see, for example, *Three Books on Life*, 28, 46, 50, 51, 83 and 86.

<sup>17</sup> *Ibn al-Qifti's Ta'rih al-hukama* (republishation of A. Müller's edition by J. Lippert) (Leipzig: 1903). 376. Cf. Kümmel, *Musik und Medizin* 61.

Ficino's concept of physiology was deeply rooted not only in his musical beliefs about the universe, but also in his astrological thinking. Both sets of belief were theoretically based on the Timaeon doctrine of the harmonic relationship between the four elements, which existed among all the different parts of the universe.<sup>18</sup> The specific astrological interpretation of the universe as a harmonic network of analogies was, however, another feature borrowed by Ficino from al-Kindi, who may have been responsible for its development.<sup>19</sup> In his *Timaeus* commentary Ficino read the passages on humours, health and harmony through the lenses of al-Kindi's astrological thought.<sup>20</sup> In his interpretation, he stresses that man must be studied as an integral part of the universe.

Although human physiology is defined by Ficino as the science of the normal phenomena of human life, it is sometimes hardly recognisable for us, because his views of 'normal human life' and 'nature' are underpinned by metaphysical, magical and astrological ideas which are remote from our modern beliefs. Therefore, knowledge of the normal phenomena of human life includes an understanding of man's place in the harmonic universe and of his goal in life. This certainly included knowledge about the four basic rhythms of life which were associated with each of the four strings of a lute, the quarters of the zodiac, the four elements, four winds, four seasons, four quarters of the month, four quarters of the day, four humours, four ages of life, four mental faculties, four faculties of the vegetative soul, and four humoral temperaments of man. Against the backdrop of this network of analogies, Ficino divides the animated human body into three parts, based on the principal cavities of head, thorax, and lower belly. In terms of cosmic analogies, the heart corresponds to the sun [Fig. 2].<sup>21</sup>

<sup>18</sup> Pl. *Ti.* 31b-32c corresponding to Ficino, *CiT*, ch. XVIII.

<sup>19</sup> Cf. Burnett, "Spiritual Medicine" 86.

<sup>20</sup> In his *Timaeus* Plato dealt with the physiological details of the union of human soul and body: heart, lung, belly, liver, marrow, bone, flesh, sinews; structure of the head at 69-76; with plants as food; veins and air passages; respiration; movement without void; projectiles and sounds; digestion at 77-80; with death and decay; physical and psychic illnesses at 81-87; and with physical fitness and psychic well-being; harmony within the individual and affinity with the cosmos at 87-90.

<sup>21</sup> Ficino, *CiT* XXXV, 1464, fol. 79 recto. The Timaeon fourfold partition of the world is reflected in the fourfold partition of man, who is composed of body, and three parts of soul. This diagram of a threefold man is based on the three parts of the human soul. Although this illustration in a treatise of Fludd (1574-1637) is a later visualisation of ideas about the human anatomy, it is used here because it illustrates Ficino's notion of physiology as a branch of an all-embracing metaphysics quite well. Ficino and Fludd share the view that, just as in the three realms of the macrocosm, the light of God is shining, so also





In Ficino’s commentary on the *Timaeus*, this knowledge was combined with musical knowledge about combinations of high- and low-sounding lute strings which, if played together, resulted in mixtures analogous to the mixing of the four qualities.<sup>22</sup> His concept of health, then, was defined in terms of the correct proportion between the parts. If there was an excess or lack of a specific body-component, physicians as well as musicians could remove it or add to or it, and thus restore the normal physical and mental balance:

Very expert doctors mix particular liquids together in particular proportions, and as a result many varied substances come together into a single new form and in a wondrous way obtain a heavenly power in addition to their original force; this transformation is evident in Mithridates’<sup>23</sup> concoction and in Andromachus’<sup>24</sup> remedy for animal bites. In the same way the most skilful musicians blend together very low tones like cold substances, and very high tones like hot ones, and moderately low tones like wet substances and moderately high tones like dry ones, these they blend together in such proportions that a distinct single form is created out of many, and that form obtains a heavenly virtue in addition to its auditory one.<sup>25</sup>

this is the case in the three realms of which man is composed. Furthermore, the highest heaven corresponds to the head, the planetary spheres or ethereal heaven to the thorax, and the elemental spheres to the abdomen.

<sup>22</sup> Ficino probably made a slight error in his explanation. Against the background of the traditional system of the four elements, humours and temperaments, medium low voices already possess a moist quality. In order to temper them, they have to acquire a dry or a hot quality. He could also have had in mind a slightly different system. Ficino’s ideas are based on a system of harmonic analogies touching less directly on music as ordered sound found, for example, in Ptolemy. See Ptolemy, *Harmonics*, tr. Barker A., *Greek Musical Writings* (Cambridge: 1989), vol. 2, 275–391.

Element	Primary qualities	Humour	Temperament	Tone
fire	dry and hot	yellow bile	choleric	high tone
air	hot and moist	blood	sanguine	medium high tone
water	moist and cold	phlegm	phlegmatic	medium low tone
earth	cold and dry	black bile	melancholic	low tone

<sup>23</sup> Fear of poisoning prompted Mithridates the Great to develop a universal antidote, with which he became the father of empirical toxicology. For the use of universal antidotes in ancient medicine, see Nutton, *Ancient Medicine* 141–142, 177.

<sup>24</sup> Andromachus developed the antidote ‘theriacus’ against bites of wild animals, which was composed of opium powdered with some tannic bitter substance. For Ficino’s use of ‘theriacus’, see Donald Beecher, “Ficino, Theriaca and the Stars”, in Allen M.J.B. et alii (eds.), *Marsilio Ficino. His Theology, His Philosophy, His Legacy* (Leiden: 2002) 243–256.

<sup>25</sup> Ficino, *CiT* ch. XXXI, 1455, fol. 70 verso ‘Quemadmodum medici peritissimi certos invicem succos certa quadam ratione commiscent, per quam in unam novamque formam plures atque diversae materiae coeant, et ultra vim elementalem virtutem quoque caelestem mirifice nanciscantur, quod in Mithridatis confectione et Andromachi theriaca est manifestum; similiter artificiosissimi musici gravissimas voces, quasi materias frigidas,

For example, if someone were agitated or depressed, a musical healer would prescribe listening, at a beneficial astrological moment, to a high and a low string (*voce*), which correspond to joy and sadness, because, when played together, they could produce the effect of equanimity in the actions of the soul.

In his commentary on the *Timaeus*, Ficino, following tradition, assigned the seven notes of a musical scale to the seven planets.<sup>26</sup> This is explained as the result of music being the science that creates harmony between the soul and the universe.<sup>27</sup> In his letter *On Musical Proportions*, following al-Kindi, Ficino developed this idea of analogy even further: the ratios which create musical harmony (octave or *dupla* – 2:1; fifth or *sesquialtera* – 3:2; and fourth or *sesquitercia* – 4:3) are said to have correspondences with the aspects formed by the planets in the heavens.<sup>28</sup> In this letter, Ficino even associated particular musical modes with the 12 signs of the zodiac, which were distributed among the four elements, the four humours, and were alternatively male and female. This musico-astrological theory opened many possibilities for Ficino. Given that he already had a good knowledge of music and astrology, as a musical healer it was relatively easy for him to diagnose a patient and to prescribe a cure.

It can now tentatively be concluded that Ficino was one of the first musical healers who went beyond the general acceptance of the essential Platonic idea that the movements of the soul must be in harmony with the movements of the universe.<sup>29</sup> As is already known, in his *Three Books on Life* he developed a theory about psychological cures through the observation of particular astrological situations.<sup>30</sup> I will now investigate how these fundamental ethical and astrological theoretical beliefs influenced his interpretation of the concept of physiology as formulated in Plato's *Timaeus* or, to reverse this proposal, how this theoretical base for music therapy was influenced by Timaeian physiology.

---

voces item acutissimas, quasi calidas, rursus mediocriter graves, ut humidus, mediocriter et acutas, ut siccus, tanta ratione contemperant, ut una quaedam forma fiat ex pluribus, quae ultra vocalem virtutem consequatur insuper et caelestem'.

<sup>26</sup> Ficino, *CiT* ch. XXXII, 1457, fol. 72 recto.

<sup>27</sup> Pl. *Ti.* 34b–36d corresponding to Ficino, *CiT* ch. XXVIII–XXXVI.

<sup>28</sup> For this letter, see *De Rationibus Musicae* in Kristeller P.O., *Supplementum Ficinianum* 54 (English translation of this letter by Farndell A. in Godwin J. (ed.), *Harmony of the Spheres. A Sourcebook of the Pythagorean Tradition in Music* (Rochester, Vt.: 1993) 167).

<sup>29</sup> Pl. *Ti.* 47d corresponding to Ficino, *CiT* ch. XXXII.

<sup>30</sup> This theory in Ficino's *Three Books on Life* has been explored in Walker D.P., "Ficino's *Spiritus* and Music", *Annales Musicologiques* 1 (1953), esp. at 140–150; and in Voss A., "Marsilio Ficino, The Second Orpheus", in Horden, *Music as Medicine*, esp. at 161–168.



*Hearing and blood circulation. Two examples of the principle  
of circular thrust*

In his commentary on the *Timaeus*, Ficino tries to identify the transactions through which music can help in promoting the return of the revolutions of the human soul to their proper order (*Timaeus* 47c–e). In his definition of sound and the sense of hearing Ficino still used a traditional theory of sensation according to which the sense-organs are of the same structure and substance as what is sensed. His ideas on the sense of hearing are embedded in the network of analogies mentioned above:

For the moment, I make but passing mention of the fact that the followers of Plato, in their scheme of the senses, match sight with fire, hearing with air, smell with a vapour blended from air and water, taste with water, and touch with earth: and they think that *wondrous pleasure appears when the proportions of something perceptible through its qualities and degrees match up and harmonise at every point with the proportions which constitute the nature of sense and spirit* [...]. The followers of Plato locate in the constitution of hearing one degree of earth; also, one of water, but with a third more; one and a half degrees of fire; and lastly, two of air. Hence they consider that the power to arise most strongly is that of the ratios of 3:4, 2:3 and 2:1.<sup>31</sup>

The sense of hearing of a normal, healthy person, then, is defined by Ficino in terms of the correct proportions between the four elements: if there is enough air in the sense of hearing, sounds can travel unhampered through the human body, and thereby influence the human soul. Following the *Timaeus*, in Ficino's commentary the sense of hearing uses the veins and the arteries inside the human body for sound propagation. This is in fact the supposed physiological basis for the putative effectiveness of Ficino's music therapy.

The proportions in the pulse of a healthy well-balanced person were also generally held to be 2:1, 3:2, and 4:3. Despite unanimous agreement that these proportions did in some sense or other occur in the duration

---

<sup>31</sup> Ficino Marsilio, *De Rationibus Musicae*, in Kristeller P.O., *Supplementum Ficinianum* 54 'Micto in presentia quod Platonici in sensibus disponendis igni visum, auditum aëri, olfactum vaporibus ex aëre et aqua mixto, gustum aque, terre tactum accommodant. Atque ubi proportio rei sensibilis per qualitates gradusque suos proportioni qua sensus ipsius spiritusque complexio constat undique quadrat et consonat, ibi putant voluptatem mirificam provenire [...]. Platonici in ipsa auditus complexione unum terre collocant gradum, aque vero unum quoque, sed tertiam insuper partem, ignis preterea unum atque dimidium, aëris denique duos. Hinc ergo vim proportionis sexquiertie, sexquialtere, duple oriri maxime arbitrantur' (English translation by Farndell A. in Godwin J. (ed.), *Harmony of the Spheres. A Sourcebook of the Pythagorean Tradition in Music* 167).

of heartbeats, many authors in the Middle Ages and early Renaissance remained doubtful of the precise relationships involved.<sup>32</sup> In order to resolve this issue, Ficino consulted Plato's *Timaeus*, convinced that a definitive solution to these problems could be found there. If we reconstruct Ficino's interpretation of the music of the pulse, we see that it is expressed in terms of rareness or density. Just as tones could be high or low, so pulses could be high (rare) or low (dense). The rareness or density of a pulse reflected the condition of someone's blood. Healthy blood will result in a regular harmonious pulse:

For a good disposition of the body (as I have said) eight parts of the blood are necessary, four of phlegm [1:2], two of [yellow or red] bile [1:4] and one of black bile [1:8]. Then so that the blood perhaps is warm by one degree and the damp is also somewhat warmer, the bile is warm by three, and phlegm damp by three. For thus the fluid of the phlegm together with the heat of the bile seems to restore the right temperament of the blood. The veins are the place of the denser blood, and the arteries of the lighter. The necessary light phlegm drains from us into the veins below the blood, in order to temper or recreate the blood. Red bile flows to the same place like some kind of thin blood. In the same place, black bile subsides like a kind of tartaric acid<sup>33</sup> of blood, but all these things are necessary in the blood both for its tempering and also for the nutrition of limbs similar to these [...].<sup>34</sup>

Expressed in proportional values, the composition of ideal blood is as follows: blood-phlegm must be in the proportion 1:2; blood-yellow/red bile in the proportion 1:4; and blood-black bile in the proportion 1:8.

In line with *Timaeus* 80d–81e, in Ficino's commentary blood is above all an expression of cosmic harmony: like everything in the cosmos it is ruled by the principle of *concordia discors*. This principle holds that cosmos is

<sup>32</sup> Cf. Siraisi N.G., "The Music of Pulse in the Writings of Italian Academic Physicians (Fourteenth and Fifteenth Centuries)" 693.

<sup>33</sup> Tartaric acid is a calcareous acid which in grey or red form often develops on the sides of wine barrels. As an invisible humour black bile was conceived of as a substance in the blood possessing properties similar to those of tartaric acid.

<sup>34</sup> Ficino, *CiT*, *Distinctiones* ch. LXXXVII, 1481, fol. 91 recto 'Ad bonam corporis habitudinem (ut ita dixerim) octo partes sanguinis necessariae sunt, pituitae quatuor, bilis duae, atrae bilis una. Item ut sanguis forte uno sit gradu calidus atque humidus forte etiam paulo calidior. Bilis tribus calida, pituita tribus humida. Sic enim humor pituitae cum bilis calore temperiem sanguinis referre videtur. Locus sanguinis crassioris venae sunt. Arteriae vero subtilioris. Subtilis pituita necessaria nobis sub sanguine venis illabitur, ad sanguinem vel temperandum, vel recreandum. Eodem confluit rubea bilis quasi tenuis quidam sanguis. Ibidem subsidet quasi faecula quaedam sanguinis, atra bilis, necessaria vero haec omnia sunt in sanguine, cum ad ipsius temperamentum, turn etiam ad membrorum his similium nutrimentum [...]'.

a reconciliation of opposites in which the parts retain their autonomous identity even though they function harmoniously in a stable system.<sup>35</sup> So, relatively noxious substances like black bile and phlegm are necessary to temper the blood. But, given that the human body is a harmonic system in itself, the processes of blood circulation and digestion are designed in such a way that an overdose of, for example, phlegm was exuded automatically on a daily basis: 'Thin phlegm that arises every day, though mixed with *blood*, drips out through *sweat* and *tears*'.<sup>36</sup>

Whereas in a healthy person the blood has a self-cleansing power, the blood of an unhealthy person loses this, as a result of which the natural process of blood circulation is interrupted: 'Sometimes the pore of the bone is so narrowed or obstructed that they can neither release dense vapours nor allow nourishment to enter'.<sup>37</sup>

When the veins or arteries were silted up, this resulted in dense blood, with a low pulse. A physician with a musical training, then, could hear in the music of the pulse if the blood was well-tempered and running smoothly. If the blood circulation was in some way slow or restricted, so that the other humours accumulated in the blood instead of leaving it in the form of sweat and tears, a musical healer could advise listening to musical modes of a stimulating, or even agitating, nature. In these cases, music functioned as an antidote against noxious substances in the blood.<sup>38</sup>

Furthermore, blood is an animated substance which contains spirit (*spiritus*), an intermediary entity between the human body and soul which facilitates communication between the different corporeal and incorporeal substances of which man is created. The incorporeal-corporeal spirit can intermingle with earthly matter and bring about changes in its form. In his commentary on the *Timaeus* Ficino explains the function of spirit as follows:

Natural heat has its tinder in the heart, and *spiritus*, that is some [rare] vapour of the blood, has it in the same place, as it is created by the same heat from the most subtle blood. Each penetrates the whole body with both a remarkable efficacy and rareness. Because *spiritus* is life-giving, it creates the expanding and contracting motion of the heart, and for that reason it

<sup>35</sup> Ficino, *CiT* ch. XXVIII, 1453, fol. 69 recto.

<sup>36</sup> Ficino, *CiT*, *Distinctiones* ch. LXXXI, 1481, fol. 91 recto 'Subtilis pituita quotidie nascens, neque dum permixta sanguini, per sudorem exstillat et lachrimas'.

<sup>37</sup> Ficino, *CiT*, *Distinctiones* ch. LXXXII, 1482, fol. 91 verso 'Nonnunquam poris ossis adeo coarctantur vel obstruuntur, ut nec emittere graves vapores possint, nec admittere nutrimentum'.

<sup>38</sup> See note 25 above.

revolves by some perpetual motion, and through its motion jumps back and forth, and it always arouses heat by its motion and carries it through everything with it.<sup>39</sup>

Ficino seeks to defend Plato's anatomical idea that the arteries are able to take in healing substances, such as musical spirits, and can relieve the body of pathogenic waste:

These [arteries] now, when they are dilated, absorb open air through the whole body both to cool down the hot spirits as well as to generate animal spirit. [But when the arteries are] compressed, they purge [the arteries] from the saturated evaporations of the spirit that had been absorbed. Such a process is characterised [by Galen] as the real perspiration.<sup>40</sup>

Ficino seeks to defend this view on the specific interrelationship of respiration and blood circulation, because it provides him with an anatomical foundation for his theory of musical healing. Spirit, in his opinion, is also an essential component of the air of which musical sound is composed. On the question of why music is capable, more than anything else, of influencing the human soul and body, Ficino responds:

The response to this would be that musical consonance occurs in the element which is the mean of all [i.e. air], and reaches the ears through motion, in fact circular motion such that it is not surprising that it should be fitting to the soul, which is both the mean of things, and the origin of circular motion. Add to this the fact that musical sound, more than anything else perceived by the senses, as if alive, takes the desire, sense, and thought of the singer's or player's soul and conveys them to the listeners' souls; thus it pre-eminently agrees with the soul.<sup>41</sup>

<sup>39</sup> Ficino, *CiT*, *Distinctiones* ch. LXXX, 1479, fol. 89 verso 'Calor naturalis fomitem habet in corde, ibidem spiritus, id est sanguineus quidam vapor, ab ipso calore ex subtilissimo sanguine procreatus. Uterque mira cum efficacia turn etiam tenuitate corpus totum penetrat. Spiritus quia et vitalis est, et motu cordis dilatante contrahenteque creatus, ideo perpetuo quodam motu revolvitur, perque meatus omnes prosilit atque resilit, suoque motu calorem semper excitat secumque per omnia transfert'.

<sup>40</sup> Ficino, *CiT* ch. XXXXVI, 1484, fol. 79 verso 'Quae quidem dilatatae externum aerem per totum corpus accipiunt et ad spiritus ferventes refrigerandos, et ad animalem spiritum generandum. Compressae vero caliginosos vapores spiritus insertos expurgant. Eiusmodi motum perspirationem proprie nominat'.

<sup>41</sup> Ficino, *CiT* ch. XXVIII, 1453, fol. 69 recto 'Responderetur ad haec musicam consonantiam in elemento fieri omnium medio; perque motum, et hunc quidem orbicularem ad aures provenire, ut non mirum sit eam animae convenire tum mediae rerum, tum motionis principio in circuitu revolubili. Adde quod concentus potissimum inter illa quae sentiuntur quasi animatus affectum sensuumque cogitationem animae sive canentis sive sonantis perfert in animos audientes. Ideoque in primis cum animo congruit'.

Thus, the structural similarity between musical and human spirit accounts for the circular transportation of music through the human body. In a literal way, listening to music is a remedy to replenish the human spirit. The correct amount of spirit inside the human body provides for a tempered blood circulation as well as for the smooth removal of waste matter, like an overdose of black bile.<sup>42</sup> In Ficino's circular model of the sense of hearing between the head and the liver the arteries are responsible for bringing the natural spirits from the liver to the heart and subsequently the vital spirits from the heart to the base of the brain, where they are transformed into extremely rare animal spirits. These spirits are the instruments through which the brain receives the external sense impressions which, when they arrive at the brain, are transformed from simple sound images carried by vital spirits into musical mirror images carried by animal spirits [Fig. 3].

Finally, demons play a very active role in Ficino's explanation of physiological processes.<sup>43</sup> The combined explanation of the sense of hearing and blood circulation constituted for him the perfect channel for demonic interplay:

We believe that the motion of such perturbation occurs for the most part in the following manner. Clearly the airy demons move the airy spirit in us, and when the spirit has so to speak vibrated, the humours too are moved in the body and images are aroused in the fantasy. But how? In the sanguine body certainly the demons entice the rational soul to empty pleasures by often moving the blood and the images in a way resembling blood.<sup>44</sup>

In the anatomy of the *Timaeus*, the lowest part of the irrational soul is kept as far as possible from the head, the seat of thought and deliberation.<sup>45</sup>

---

<sup>42</sup> Traditionally black bile was considered as something harmful, because it was supposed to cause melancholy. The literature about Ficino's famous reformation of this doctrine is vast, but particularly illustrative in the context of this article is Kümmel, *Musik und Medizin* 285–306, esp. 288–290.

<sup>43</sup> The classical treatment of Ficino's demonology is in Walker D.P., *Spiritual and Demonic Magic from Ficino to Campanella* (London: 1958). Although Ficino tried in his commentary on the *Timaeus* as well as in his other texts to distance his own beliefs from unorthodox ones, his writings resurrect the possibility that music may be used in incantations, magical and demonic rituals, and other practices seen as 'suspect' from a Christian perspective.

<sup>44</sup> Ficino, *Theologia Platonica* XVI.VII.18 'Perturbationis huius motum ita potissimum fieri arbitramur. Movent sane aereum in nobis spiritum aerei demone, quo quidem quasi vibrato et humores movementur in corpore et in phantasia imagine excitantur. Sed quonam pacto? Nempe in sanguineo corpore sanguinem imaginesque quodammodo similes saepius commoventur ad inanes animum voluptates alliciunt' [English translation by Allen M.J.B., *Platonic Theology* 5, XVI.VII.18, 308–309].

<sup>45</sup> Pl. *Ti.* 70d–72b.

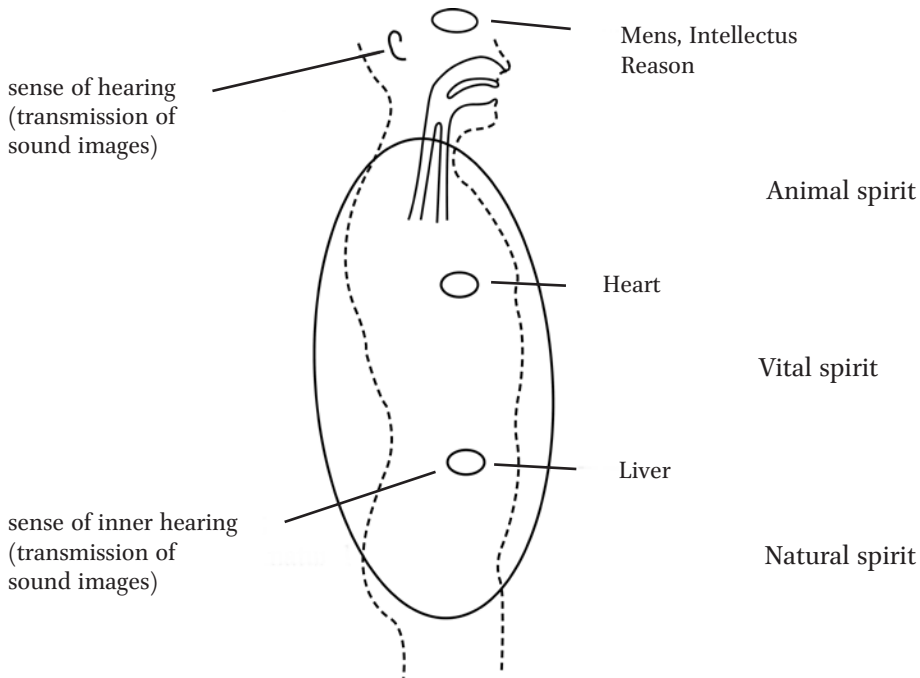


Fig. 3. Blood circulation and the sense of hearing following the same archetypal laws of circular thrust. Based on Plato's *Cosmology. The Timaeus of Plato*, tr./comm. MacDonald Cornford F. (London-New York: 1937).

It has no understanding of intellect and reason, and even when it gains some awareness of such things it is not in its nature to discern them.<sup>46</sup> The lower part of the irrational soul is influenced, instead, by images and phantasms.<sup>47</sup> By making the liver dense and smooth and shiny, the gods in the *Timaeus* charged with the creation of man enabled this organ to serve as a mirror which reflects the power of thoughts, transmitted from the mind, receiving and emitting these thoughts as 'images'. In Ficino's commentary on the *Timaeus* this passage provides a clue to the way in which music presents itself to the part of the soul responsible for perception and emotion. Hearing is envisaged as a movement that is transmitted between the head and the liver, and the perceptive irrational soul can act as a receptor for anything that is reflected from the liver's smooth

<sup>46</sup> Pl. *Ti.* 70d–71a.

<sup>47</sup> Pl. *Ti.* 71a–b.

surface. Although in his commentary Ficino does not openly adhere to this Pythagorean doctrine, he deals with it in detail:

In fact concerning the liver itself you have to observe the remarkable opinion of the Pythagoreans, namely that this organ, made of a certain hardness and an equally shining softness, is harmoniously tuned in such a way that it receives the images of things in the manner of a mirror and easily reflects them.<sup>48</sup>

Even though Ficino had a genuine interest in the natural phenomena of human life, he could see them only through the lenses of his metaphysical theory. The 'nature' of which Ficino speaks is not our observed nature, but the supernatural nature of the intelligible harmonic realm. 'Supernatural' hearing in which demonic influence on the liver was involved, therefore, was still a necessary concept in Ficino's account of music's power over man's soul.

### *Conclusion*

In conclusion, I would like to return to Fig. 1, where a physician is taking the pulse of a plague victim, and ask whether Ficino's study and interpretation of the ideas found in the *Timaeus* about human physiology and health would have increased insight into the medical condition or prognosis of the patient depicted there. At first sight, the answer would appear to be in the affirmative. In Ficino's treatises a critical attitude towards the authoritative writers of the past comes out in occasional paragraphs, an attitude which could almost be regarded as 'early modern'. In his treatise *The Counsel against the Plague*, for example, on the basis of his own personal experience with plague victims, he strongly argues against medical authorities who hold that this illness was transmitted through the thinnest and purest air, that is, spirit or ether, which, according to Ficino, ran counter to the most elemental physical laws and against experience.<sup>49</sup> But, if we take a closer look, it is clear that Ficino's personal experience

---

<sup>48</sup> Ficino, *CiT* ch. XXXXV, 1465, fol. 79 recto 'Verum de hoc ipso iecore miram Pythagoricorum notabis opinionem, videlicet id membrum ex certa soliditate et clara pariter lenitate, sic esse temperatum, ut speculi modo imagines rerum accipiat, facile admodum atque reddat'.

<sup>49</sup> Ficino Marsilio, *Il Consilio contro la Pestilentia* (Florence: 1481) 2 verso, quoted in the introduction of the edition of this text by Katinis T., *Medicina e Filosofia in Marsilio Ficino. Il Consilio contro la Pestilenza* (Rome: 2007) 80.



and observations were deeply rooted in his metaphysical conception of the cosmos and, as a consequence of this, he could not allow spirit or ether to be somehow impure, because that would deprive him of the theoretical base for his healing practice.

Against this backdrop, it comes as no surprise that, where Ficino reports his own healing practices, he banishes any comments about failure: such an outcome is usually attributed to the failure of the patient to follow his prescriptions properly. As an example of this rhetorical strategy, for example, he warns his readers not to follow the superstition of one of his patients who thought that, if one had recovered successfully from the plague once, one would be immune for the future:

In that year, in the month of September, I healed a woman from the illness [i.e. the plague], subsequently, when she felt healthy [again] like any other person, she talked to victims of the plague and became ill again after eighteen days, and died because she could not take her medicine in time.<sup>50</sup>

So, from the total absence of doubt or even uncertainty about his diagnoses and cures, we may gather that Ficino was fully convinced of the truth of his own physiological and medical knowledge, which was based on traditional ways of thinking in terms of cosmic analogies. Even if Ficino could have deduced from the music of the pulse that a patient had the plague – which has, as one of its symptoms, a high fever, and consequently a heightened heartbeat – and gave him an adequate therapeutic prescription, for example of a musical antidote, nevertheless, given the total absence of an understanding of the plague, in my opinion the recovery of the patient would still be down to good luck.

While I would argue that, by the second half of the fifteenth century, humanist learning had begun to penetrate the discipline of medicine itself, this development had very little impact on traditional humoral pathology. This lack of influence is not difficult to understand. Scholars like Ficino, who were versed in late medieval medicine, continued to rely on traditional humoral medicine, because it was a sophisticated discipline with a tested method of putting it into practice.<sup>51</sup> In this way, the medical tradition hindered the assimilation of new texts, such as Plato's *Timaeus*,

---

<sup>50</sup> Ficino, *Consilio* 47 recto, in Katiniš T., *Medicina e Filosofia* 81 '[...] in questo anno, nel mese di settembre, io liberai una donna dal morbo, poi, sendo sana come qualunque altra persona, conversò con amorbati et rammorbò doppio giorni diciotto et perì non havendo le medicine a tempo'.

<sup>51</sup> This conclusion supports the results of Park, *Doctors and Medicine* 237–239.

and new approaches. Esoteric interpretations concerning the music of the pulse were of little or no use for doctors inside the context of the medical faculties of the Italian universities, a system which had been in place for two centuries. This explains why no coherent school of medical humanism or Renaissance medicine emerged until the sixteenth century; and, when it did, Ficino's music therapy played no part in it. His musico-therapeutical ideas, however, became immensely popular in the sixteenth century in elite circles all over Europe. Even today, Plato's aversion to regular medicine and his preference for a healthy regime informed by a profound knowledge of human physiology<sup>52</sup> – which experienced a revival in Western culture partly as a result of Ficino's commentary on it – remains a voice in contemporary debates about health and medicine.

---

<sup>52</sup> Pl. *Ti.* 87–90.

*Selective bibliography*

- BURNETT C., "“Spiritual Medicine”: Music and Healing in Islam and its Influence in Western Medicine", in Horden P. (ed.), *Music as Medicine. The History of Music Therapy since Antiquity* (Aldershot etc.: 2000) 85–91.
- BURNETT C. – FEND M. – GOUK P. (eds.), *The Second Sense. Studies in Hearing and Musical Judgement from Antiquity to the Seventeenth Century* (London: 1991).
- FICINO MARSILIO, *Commentaria in Platonem* (Florence: 1496).
- , *De Rationibus Musicae*: in P.O. Kristeller, *Supplementum Ficinianum* 54 (English translation of this letter by Farndell A. in Godwin J. (ed.), *Harmony of the Spheres. A Sourcebook of the Pythagorean Tradition in Music* (Rochester, Vt.: 1993) 167).
- , *Theologia Platonica*: trs. Allen M.J.B. – Warden J.; Latin text eds. Hankins J. – Bowen W. (2001–2006), *Platonic Theology*, Cambridge, Mass.
- , *De vita libri tres*: A critical eds/trs. Kaske C.V. – Clark J.R. (1989), *Three Books on Life*, Binghamton, NY.
- GOUK P. (ed.), *Musical Healing in Cultural Contexts* (Aldershot: 2000).
- HANKINS J., *Plato in the Italian Renaissance* (Leiden: 1990).
- , "The Study of the *Timaeus* in Early Renaissance Italy", in Grafton A. – Siraisi N. (eds.), *Natural Particulars. Nature and the Disciplines in Renaissance Europe* (Cambridge, MA etc.: 1999) 77–95.
- KATINIS T., "Bibliografia Ficiniana: Studi ed Edizioni delle Opere di Marsilio Ficino dal 1986", *Accademia* 2 (2000) 101–136 [A bibliography from 1986 to 2000; updated annually].
- , *Medicina e Filosofia in Marsilio Ficino. Il Consilio contro la Pestilenza* (Rome: 2007).
- KRISTELLER P.O., "The Scholastic Background of Marsilio Ficino with an Edition of Unpublished Texts" [*De Sono*], *Traditio. Studies in Ancient and Medieval history* (1944) 257–318.
- KÜMMEL W.F., "Der Puls und das Problem der Zeitmessung in der Geschichte der Medizin", *Medizinhistorisches Journal* 9 (1974) 1–22.
- , *Musik und Medizin. Ihre Wechselbeziehungen in Theorie und Praxis von 800 bis 1800* (Freiburg [Breisgau] etc.: 1977).
- NUTTON V., *Ancient Medicine* (London: 2004).
- , "De Placitis Hippocratis et Platonis in the Renaissance", in Manuli P. – Vegetti M. (eds.), *Le Opera Psicologiche di Galeno* (Naples: 1988) 281–309.
- PARK K., *Doctors and Medicine in Early Renaissance Florence* (Princeton: 1985).
- PLATO, *Timaeus*: tr./comm. Cornford F.M. (1937), *Plato's Cosmology. The Timaeus of Plato*, London.
- PRINS J.W., *Echoes of an Invisible World. Marsilio Ficino and Francesco Patrizi on Cosmic Order and Music Theory* (Alblasserdam: 2009).
- SIRAIISI N.G., "The Music of Pulse in the Writings of Italian Academic Physicians (Fourteenth and Fifteenth Centuries)", *Speculum* 50 (1975) 689–710.
- VOSS A., *Magic, Astrology and Music. The Background to Marsilio Ficino's Astrological Music Therapy and his Role as a Renaissance Magus*, unpublished dissertation (London: 1992).
- , "Marsilio Ficino, The Second Orpheus", in Horden P. (ed.), *Music as Medicine. The History of Music Therapy since Antiquity* (Aldershot etc.: 2000) 154–172.
- WALKER D.P., "Ficino's *Spiritus* and Music", *Annales Musicologiques* 1 (1953) 131–150 [repr. in Gouk P. (ed.), *Music, Spirit and Language in the Renaissance* (London: 1985)].
- , *Music, Spirit and Language in the Renaissance*, ed. Gouk P. (London: 1985).
- , *Spiritual and Demonic Magic from Ficino to Campanella* (London: 1958).



'FOR THE LIFE OF A CREATURE IS IN THE BLOOD' (*LEVITICUS* 17:11).  
SOME CONSIDERATIONS ON BLOOD AS THE SOURCE OF LIFE  
IN SIXTEENTH-CENTURY RELIGION AND MEDICINE  
AND THEIR INTERCONNECTIONS

Catrien Santing

*Summary*

This article studies the different meanings of blood, focusing on the Early Modern period in which the unravelling of its secrets worked not only at a medical level, but also in relationship to philosophy and religion. My points of departure are the works of two sixteenth-century medical authors, the Dutchman Levinus Lemnius and the Italian Andrea Cesalpino. It is claimed that they were much more interested in physiology than in anatomy, and that only in that context can we fully appreciate the value of blood. Inspired by recent work on the role of blood in religious history, such as Caroline Walker Bynum's *Wonderful Blood*, I present blood as a substance that, due to its immense value, tended to lose its materiality and took on spiritual aspects, which made devotional interpretations inevitable. By exposing its non-corporeal aspects, the association with God, especially with the Holy Spirit and its terrestrial emanation, becomes evident. No matter how much they exploited not only Aristotle, but also Galen, the arguments of both Lemnius and Cesalpino had at their centre a spiritualisation of blood. In his extensive *regimina*, the more traditional Levinus Lemnius emphasised the *spiritus vitalis* that determined the quality of blood. At its most refined stage, it approached the *spiritus universalis*, and almost converged with the Holy Spirit. Likewise, the Aristotelian Cesalpino placed the heart and the spiritualised human fuel, blood, again and again at the centre, bringing everything back to its origin, God: the *deus rotator*.

In recent publications on the Early Modern period, anatomy has been at the centre of attention. The opening up of bodies during the Renaissance, which took place despite existing taboos or merely because of an urge to find material evidence for either medical complaints or religious miracles, has proved to be a fruitful subject of research from a medical-historical perspective. In this respect, the ingenuity of Andreas Vesalius' self-display still reverberates today. This self-acclaimed and, until now, widely-endorsed view that anatomy played the star role may explain the relative neglect of blood in medical-historical studies. The fact of the matter is that, until the seventeenth century when Harvey made his breakthrough

on its circulation, blood was a minor topic in elite western medicine.<sup>1</sup> Anatomical textbooks hardly dealt with the blood and, when they did, the authors mainly enlarged upon the spirits it carried through the body. This does not mean that blood was completely disregarded in premodern medical science and practice. Indeed, I would argue the reverse. But, in order to expose the value of blood for that period, medical historians should avoid the temptations of anatomy and study early modern physiology in combination with natural philosophy.

This is what Jean Fernel did in his *Physiologia* (1542), a survey that carefully discusses the generation and function of blood, as well as the different varieties of the liquid itself. In his comprehensive *Universa medicina* (1567), Fernel defined physiology as follows: 'So as the five parts of a complete medicine are set in order, physiology will be the first of all; it concerns itself with the nature of a wholly healthy human being, all the powers and functions'.<sup>2</sup> This statement shows that, during the sixteenth century, physiology was judged to be far more important than anatomy. Early modern anatomy investigated the parts of the body that are within reach of the senses. By exploring their structure, action and use, anatomists tried to answer the question of how they functioned, and in this way attempted to unravel the sources and secrets of life.<sup>3</sup> Physiology built on the results of anatomical research, but itself aimed higher, claiming to penetrate the nature of things. Its central principle was to establish why the body was constituted and functioned as it did. Its practitioners showed by logical demonstration how, as a branch of natural philosophy, it revealed not only the causal operations of the body, but also the causes of human nature. Of course, at this time anatomy and physiology were related, sometimes being practised by the same person. For this paper, however, it seems crucial to carefully distinguish between them and to concentrate on the latter.

---

<sup>1</sup> Cunningham A. "The Principality of Blood: William Harvey, the Blood, and the Early Transfusion Experiments", in: Santing C. – Touber J. (eds.), *Blood Symbol Liquid* (Louvain: 2011) 193–205.

<sup>2</sup> Forrester J. tr/ann., *The Physiologia of Jean Fernel* (Philadelphia: 2003) 5.

<sup>3</sup> This means that present-day (experimental) physiology resembled what was then labelled anatomy. This confusion is carefully unravelled in Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665 and idem, "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.

In this chapter, two sixteenth-century medical authors, Levinus Lemnius and Andrea Cesalpino, will be closely examined in order to highlight the value of blood in its various connotations for early modern medical doctors. While other doctors could have been selected, these two provide a useful combination: one doctor writing for the general public and living in Reformation Northern Europe, the other highly academically trained and practising in the service of the papal court. Both doctors were interested in anatomy and followed its findings, but appear not to have been anatomists themselves. Instead they pursued Fernel's line of argument and fully developed their physiological concepts in accordance with the foundations of natural philosophy.

In the analysis of their works, a third factor will be brought in, that of religion. Both authors not only lived in an era of great religious upheaval, but were also intensely devout and as such heavily engaged with the developments of the Reformation and Counter-Reformation respectively. Although a canon in later life, the Dutch Levinus Lemnius was under suspicion of sympathy towards the Reformation; indeed, his works were eventually placed on the Spanish-Dutch index of forbidden books.<sup>4</sup> His name features in Piero Camporesi's book, *Il sugo della vita* (1984), which embraces all aspects of the liquid, blood.<sup>5</sup> Although presented in a disparate, at times chaotic, form, this brief and sketchy work already touches upon many of the ideas about blood explored by Caroline Walker Bynum and Miri Rubin, to which I shall return shortly. The title is almost untranslatable, since its English translation, *Juice of Life*, clearly pales before the original. Camporesi referred to blood as eternally moving and simmering, hailing it as the treasury of human life, just as is the case with the most common (red) sauce in the Italian kitchen, *sugo bolognese*, the product of Camporesi's hometown of Bologna. The book usefully develops the positive, not to say nutritious, wholesome and hearty reminiscences of blood, not only in the lives of saints – which formed a priceless source for Camporesi – but also in many medical treatises, such as the comprehensive *Regimina* of Lemnius, which were even translated into Italian openly a few years after their publication. The second protagonist of this paper is the Italian medical professor, papal physician and devout Catholic, Andrea Cesalpino. He, rather than William Harvey, has been

---

<sup>4</sup> Reusch Fr.H., *Der Index der verbotenen Bücher ein Beitrag zur Kirchen- und Literaturgeschichte* (Bonn: 1883) I, 497.

<sup>5</sup> Camporesi P., *Il sugo della vita. Simbolismo e magia del sangue* (Milan: 1984).



claimed by some Italian authors as the discoverer of the circulation of blood,<sup>6</sup> a claim that has been refuted definitively by authors such as Walter Pagel and Jerome Bylebyl.<sup>7</sup> By focusing on Lemnius' and Cesalpino's views on blood, it will become apparent that there is a relationship between the traditional *homo sanguinicus* – so widely known from medieval and Renaissance medical *consilia* and *regimina* as well as from research on the heart and the circulation of blood by sixteenth-century anatomists – and the blood dripping from the body of the Crucified Jesus or Man of Sorrows celebrated in European art and devotional treatises dating from the same period as the works of Lemnius and Cesalpino.

While blood has been relatively neglected in medical history, there has been considerable recent enthusiasm for it in more mainstream historical publications. The precious liquid, however, is to be encountered overwhelmingly in the field of recent history of religion, notably in the history of its customs, practices and rituals. In the slipstream of the history of the body over the last twenty years, this field has seen an avalanche of publications on blood. Here it will suffice to mention Miri Rubin's *Corpus Christi. The Eucharist in Late Medieval Culture* and Caroline Walker Bynum's latest book *Wonderful Blood*, as they are the foremost protagonists of this line of approach, but of course there are many, many more.<sup>8</sup> Both authors played a pivotal role in the 'bodily turn' in the history of the church and theology. Rubin was one of the first to call the attention of cultural historians to the phenomenon of transubstantiation. According to this thirteenth-century church doctrine, all of Christ, both body and blood, was transubstantiated in the consecrated wine and bread. Walker Bynum's book represents a slight shift of orientation for this prolific author. She supplemented her usual corporal concerns with scrutiny of a far less tangible substance: Holy Blood and its veneration. Many of her assertions yield fruitful insights for medical historians and will therefore be used here to draw attention to

<sup>6</sup> Archieri J.P., *The Circulation of Blood and Andrea Cesalpino of Arezzo* (New York: s.a.) and Piccini S., *Andrea Cesalpino scopritore, William Harvey promulgatore della circolazione sanguigna* (Milan: 1963).

<sup>7</sup> Pagel W., *William Harvey's Biological Ideas* (New York: 1967), esp. 169–209 and idem, "The Claim of Cesalpino and the First and Second Editions of his Peripatetic Questions", *History of Science* 13 (1975) 130–138; Bylebyl J.J., "Cesalpino and Harvey on Portal Circulation" in Debus A. (ed.), *Science, Medicine and Society in the Renaissance* (New York: 1973) I, 39–52 and idem, "Nutrition, Quantification and Circulation", *Bulletin of the History of Medicine* 51 (1977) 369–385.

<sup>8</sup> Rubin M., *Corpus Christi. The Eucharist in Late Medieval Culture* (Cambridge: 1991); Bildhauer B., *Medieval Blood* (Cardiff: 2006) and Walker Bynum C., *Wonderful Blood. Theology and Practice in Late Medieval Northern Germany and Beyond* (Philadelphia PA: 2007).

certain aspects of sixteenth-century medical views on blood. Much of *Wonderful Blood* is dedicated to how, why and when blood became a pre-eminent subject in Northern European art. The concern with the blood of Christ and its equivalents in other human bodies, and even in mammals, also provided an opportunity to explore what were then considered to be crucial philosophical and religious issues, which Walker Bynum explores. She shows that the precious liquid provided a focus for intense debate about the nature of matter, humanity, God and the entire universe. Since medical doctors and other authors shared a common ground of culturally agreed assumptions, a similar fascination with blood can be found in medical publications of that time, where medical and religious reasoning are amalgamated in exploring the numerous different notions and connotations of blood.<sup>9</sup> In addition to the traditional medical authorities, writers quoted freely from biblical, hagiographical and literary sources and almost united these into one single perspective. In his *Anatomical Renaissance*, Andrew Cunningham proposed studying the sixteenth-century enterprise of investigating nature in precisely these terms, considering that 'nature' was religiously steered and understood. In the present article, too, I work from the assumption that in the sixteenth century there was no fundamental divide between science and religion.<sup>10</sup>

Walker Bynum's observations compel us to look differently at the publications by sixteenth-century medical doctors.<sup>11</sup> To begin with, she contests the idea that, in the Late Middle Ages and the Renaissance, the connotations of blood were principally negative: suffering, mutilation of the body and violence, all manifestations which carry undertones of death.<sup>12</sup> Looking at the many images of blood piety, such as the Masses of Saint Gregory or the many *Men of Sorrows* which were tremendously popular in this period, it is clear that blood emerges as streaming, flowing

---

<sup>9</sup> Siraisi N.G., "Life Sciences and Medicine in the Renaissance World" in Grafton A. (ed.), *Rome Reborn. The Vatican Library & Renaissance Culture* (Washington: 1993) 169–198 and idem, "Signs and Evidence: Autopsy and Sanctity in Late Sixteenth-Century Italy" in Siraisi N.G. (ed.), *Medicine and the Italian Universities, 1250–1600* (Leiden: 2001) 356–380.

<sup>10</sup> Cunningham A., *The Anatomical Renaissance. The Resurrection of the Anatomical Projects of the Ancients* (Aldershot: 1997). Valuable are also idem, "Sir Thomas Browne and his *Religio Medici*: Reason, Nature and Religion" in Grell O.P. – Cunningham A. (eds.), *Medicine and Religion in Seventeenth-Century England* (Aldershot: 1997) 12–55 and Helm J. – Winkelmann A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001).

<sup>11</sup> For this argument see Walker Bynum C., *Wonderful Blood*, the introduction, "A Frenzy for Blood" 1–23 and ch. vii "Living Blood Poured Out".

<sup>12</sup> Walker Bynum, *Wonderful Blood* 14–15.

or even welling up [Fig. 1]. It is not dried in clots, as would be expected in case of the depiction of the corpse. What we encounter in these images is *sanguis*, that is, living blood, rather than *cruor*, coagulating blood, to use the distinction that many authors preferred.<sup>13</sup> In images and in the scriptural renderings of many visions, Jesus is not dead. The wound in his side, created by the lance well before he breathed his last, bleeds copiously and usually functions as the central feature. This was interpreted as the 'opening up of Christ', which gave humanity access to the sacraments through the door of life, leading to the possibility of eternal life. Blood in its entirety functioned as the secret of life and as food for the human soul.

Walker Bynum's section on 'Blood as *sedes animae*' develops this reasoning.<sup>14</sup> The title refers to *Leviticus* 17.11, *Anima carnis in sanguine est* (For the life of a creature is in the blood). Here Walker Bynum discusses popular preaching texts, implying that blood was valued as the transporter and source of life. As a vehicle of the soul, blood was allegorically, symbolically and, I would like to add, also literally, fastened to spirit. Whereas in much discourse the body/blood contrast illustrates the opposition of body and soul, Walker Bynum's material shows that it is better to see the two as connected and bring them into harmony. This is what the Carthusian, Petrus Dorlandus († 1507), did in his devotional treatise *Viola animae*, very popular throughout the sixteenth century. A very special donation, a blood transfusion by Jesus to humankind, is described as follows:

He wished to be wounded that he might repair our wound and poured out his blood that he might by grace revive to life those only half alive. For just as the life of all ensouled creatures is in the blood, so the life of the just person comes through the blood of Christ, which he therefore in compassionate generosity pours out from his body so that you can drink it with your mouth and slake your thirst from it in your heart.<sup>15</sup>

The story about an alleged blood transfusion given to the dying Pope Innocent VIII in 1492 recorded by the chronicler of scandals, Stefano Infessura, proves my point of blood being the pre-eminent life-giving potion in more than one sense. Three small boys are said to have donated their blood, resulting in their own demise and that of the Pope. While the annalist

<sup>13</sup> Walker Bynum, *Wonderful Blood* 17–18.

<sup>14</sup> Walker Bynum, *Wonderful Blood* 161–166.

<sup>15</sup> Walker Bynum, *Wonderful Blood* 163.



Fig. 1. Jacob van Oostsanen, *Man of Sorrows*, ca. 1520.

did not reveal the details of the transfusion, it seems likely this was by drinking the blood.<sup>16</sup>

Here, therefore, I will be discussing blood as the source and seat of life in its fullest sense. Following the line of reasoning used by both Cunningham and Walker Bynum, I will then show that it needs to be separated in some ways from the body. I will argue that historical, medical-historical and religious-historical studies on blood have understood the liquid rather too materially, too bodily and too literally. Since blood was deemed to be involved with the soul, a more holistic approach appears justified. This concurs with Cunningham's allegation that anatomy in the western tradition was essentially about the soul, a statement that prevails in early modern medicine as a whole.<sup>17</sup> According to premodern medical and theological discourses it carried spirit or spirits – with and without a capital S – through the body.

*Bloud and spirite the treasure of lyfe*<sup>18</sup>

Levinus Lemnius (1506–1568) studied in Louvain, practised in Zeeland and travelled to Italy as well as to London.<sup>19</sup> He was the author of lengthy medical works. Although they were originally written in Latin, their content was of a practical and advisory nature. With amazing speed, these voluminous publications were translated into the vernacular and remained in print in Italian, French, English and German until the end of the seventeenth century.<sup>20</sup> Evidently, many readers longed for substantial, but at the same time legible, information on how to procure and preserve health and happiness. It was precisely these qualities that made Lemnius' encyclopaedic works – which are densely packed with quotations from

<sup>16</sup> Infessura S., *Diario della città di Roma di Stefano Infessura scriba senato. Nuova edizione a cura di Oreste Tommasini* (Rome: 1890) 275–276.

<sup>17</sup> Cunningham, *Anatomical Renaissance*, esp. 196–197.

<sup>18</sup> Lemnius Levinus, *The touchstone of complexions. Expedient and profitable for all such as bee desirous and carefull of their bodily health. Contayning most ready tokens, whereby every one may perfectly try, and thorowly know, as well the exact state, habit, disposition, and institution of his body outwardly: as also the inclinations, affections, motions, and desires of his minde inwardly* (London, Jo. Streater and Humphrey Moseley: 1633) 86.

<sup>19</sup> Hoorn C.M. van, *Levinus Lemnius (1505/1568). Zestiende-eeuws Zeeuws geneesheer* (Amsterdam: 1978).

<sup>20</sup> On this phenomenon in England: Slack P., "Mirrors of Health and Treasures of Poor Men: The Uses of the Vernacular Medical Literature of Tudor England" in Webster Ch. (ed.), *Health, Medicine and Mortality in the Sixteenth Century* (Cambridge: 1979) 237–242.



ancient medical and literary authors as well as from the Bible and the church fathers – so attractive. His *De miraculis occultis naturae* (first edition, Antwerp 1559) considers the signs, sources and causes of the several wonders of nature. The book attempts to explain these by observation and reasoning but was aimed to demonstrate and glorify the vastness and perfection of God's Creation, with man as the summit, paying due tribute to the leading role of the soul. Tellingly, chapter xi is entitled 'The soul of man comes not from the parent's seed but is infused by God'.<sup>21</sup> It is not possible to define Lemnius' confessional views as either Catholic or Protestant. He was certainly critical towards the Mother Church, in particular criticising the veneration of saints, but in his works he stressed the centrality of Christ's blood shed for men, as represented in the Holy Sacrament. Taking the sacrament ensured that 'Christ is in us and we in him (...). We are confident [...] that faith infused into us by the Spirit, prompts us'.<sup>22</sup> Lemnius' urge to decipher the wonders of God's creation is also apparent from his two works on vegetation in the Bible.<sup>23</sup>

For a treatise on the hidden forces of human existence, it is likely that the secret of life played a leading role here. Much attention is therefore paid to the significance of the various humours, especially to their role in the constitution of a human being. Although the soul is considered more important than the body, in the exhortation that teaches 'how to lead a life that shall be most excellent' the reader is told to take meticulous care of the body, since it is the house of the soul.<sup>24</sup> It is claimed that, in force and value, blood lies far above the other three humours, as long as it remains pure, clean and clear, of course. For example, Lemnius states that when it becomes too thick, people tend to become fierce, cruel,

---

<sup>21</sup> English translation: 'The secret miracles of nature in four books. Learnedly and moderately treating of generation, and the parts thereof, the soul, and its immortality, of plants and living creatures, of diseases, their symptoms and cures, and many other rarities [...]: whereunto is added one book containing philosophical and prudential rules how man shall become excellent in all conditions, whether high or low, and lead his life with health of body and mind' (London, Jo. Streater and Humphrey Moseley: 1658) 22.

<sup>22</sup> Lemnius, *De miraculis occultis naturae* (Antwerp 1559), ch. xiv, esp. 56. Lemnius' religious views van Hoorn, *Lemnius* 55–56.

<sup>23</sup> *Herbarum atque arborum quae in Bibliis passim obviae sunt* (Antwerp, Gulielmus Simonis: 1564) and *Similitudinum ac parabolarum, quae in bibliis ex herbis atque arboribus desumuntur, dilucida explicatio* (Antwerp, Guillemus Simonis: 1568).

<sup>24</sup> Lemnius Levinus, *Secrets* chs. XXI and XXII, 332–335. There are parallels with Melancthon; compare Helm J., 'Religion and Medicine: Anatomical Education at Wittenberg and Ingolstadt' in Helm J. – Winkelmann A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001) 51–68, esp. 54–62 and Cunningham, *Anatomical Renaissance* 230–233.

inhospitable and even inhumane. Such a quality of the blood was characteristic of those engaged in the rougher professions, such as musicians, potters, messengers, mariners and soldiers. Such people, he argues, held no regard for conscience and often little respect for religion. The thickness of their blood engendered 'grosse and troublesome spirits', which resulted in deficient principles, a darkened mind and many vices; indeed, even in godlessness.

When speaking of the sanguine constitution in general, the author points out that it combined the qualities of heat and moistness. This implied excellent health, especially in youth, when people are most full of blood. However, no matter how admirable this constitution, it could lead to frivolity and even result in licentious and thus inhumane behaviour. Sometimes sanguine temperaments could become excessively involved in physical activity, song, storytelling and other pleasures. Since the humours were seen as the causes of the passions, these delights had dangerous consequences. During these times of indulgence, the heart was prone to be affected, as the humours started to boil. The spirits in blood were especially likely to rise up and brim over. Consequently, the mind could become inflamed and produce either extreme joy or excessive anger. The latter condition, especially, was highly dangerous and in some cases resulted in death, with the blood withdrawing from and forsaking the heart, or choking the heart in its abundance.<sup>25</sup>

Lemnius' *De habitu et constitutione corporis* (1561) was likewise a best-seller in various countries. The work is in fact a very sophisticated *Regimen* directed towards a variety of medical professionals. It describes the best type of human being, explaining the humours, the elements, spirits, qualities and temperaments. In English, the book is called *The Touchstone of Complexions* and it was translated in 1576 by the London physician and poet, Thomas Newton [Fig. 2].<sup>26</sup> In this treatise, blood is also presented as a very special humour and hailed as the most excellent of the four.

What does Lemnius argue? The best type of human, he says, is one who meets the requirements of Polyclitus' *Canon*, a reference to the perfect sculpture of a man produced in the fifth century BC by the Greek Polyclitus. In his *De tuenda valetudine*, a very important source for Lemnius' work and quoted numerous times, Galen expanded on Polyclitus' ideas from a medical point of view by equating harmonious human

<sup>25</sup> Lemnius, *Secrets* 60–62.

<sup>26</sup> On Newton: van Hoorn, *Levinus Lemnius* 62, 310–311.



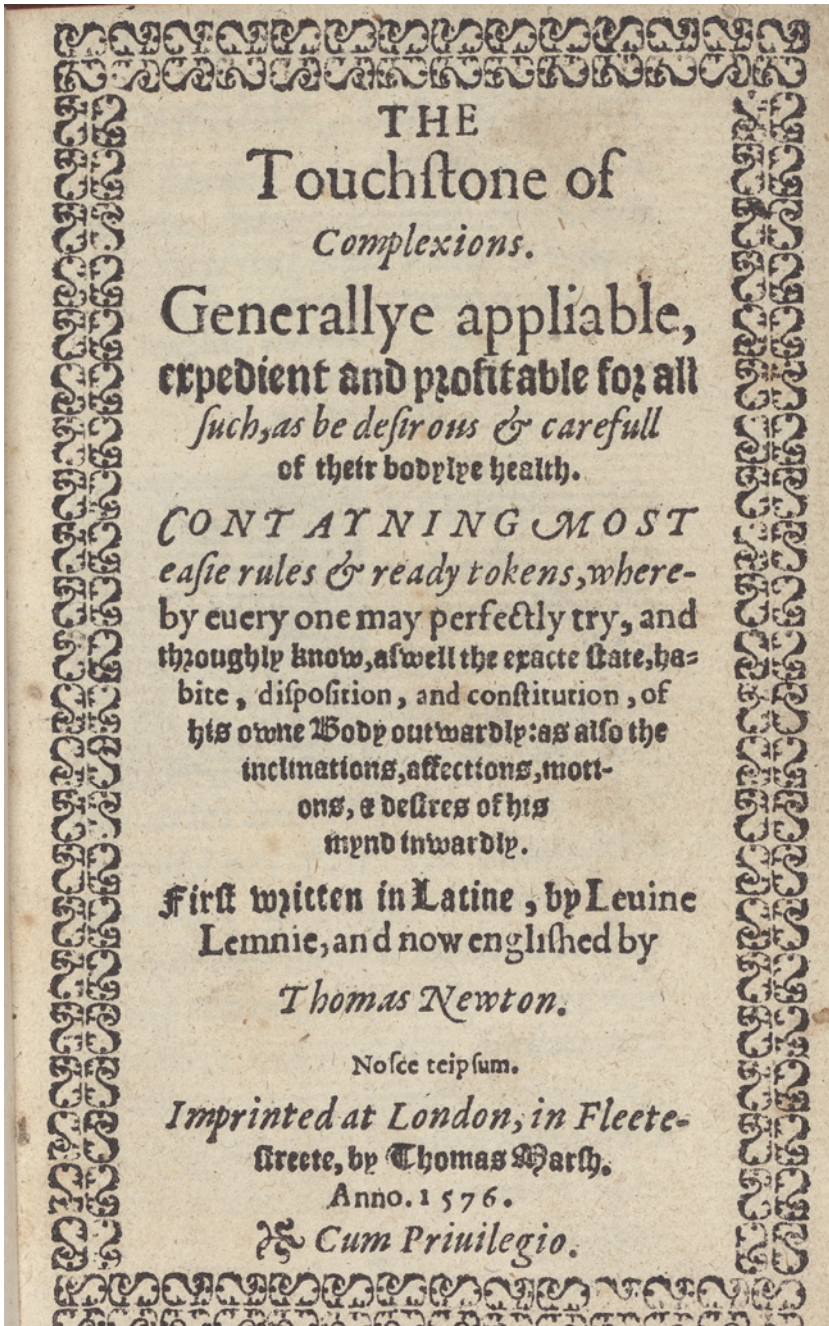


Fig. 2. Title page of the English translation of Lemnius' *De habitu et constitutione corporis*, tr. Newton Thomas (London, Thomas Marsh: 1576).

proportions and splendour to a balance of the humours and temperament. Henceforth, beauty, health and happiness were on a par.<sup>27</sup> This is also Lemnius' conclusion. What he describes as the *Regula Polycleti* had to be followed, given that it was the touchstone for a congruent and proportionate distribution of humours and spirits in the human body, leading at the same time to soundness and perfection.<sup>28</sup> Here, it is not necessary to repeat Lemnius' ideas on the generation of the spirits and temperaments, as they are genuinely Galenic and thus familiar to us.<sup>29</sup>

Blood is considered to be extremely important here because it carried the spirits through the body. Lemnius makes these even more valuable by completing them with a fourth one, the *spiritus universalis* or Spirit of God, next to the Galenic *spiritus naturalis, vitalis and animalis*. This substance, he claims, mixes in the human body with the other spirits and makes man the true heir of God and his son. It was God's breath that had animated dead matter, and which was felt by every living creature from the most humble plant to man himself. For Lemnius, the construction of a fourth spirit allowed him to round off Galen's *Regula* and link the new list of four spirits, including one which was genuinely spiritual, with the four elements, four humours and four temperaments.<sup>30</sup> That fourth spirit was, of course, the principal one, which brought the others together into one harmonious whole and directed them in the execution of their function:

For the heavenly Spirite, is the guyde and governor of the Spyrites of mans bodye, which are then more qualefyed, quieted, and kept under better order, when they be governed and ledde by the conducte and direction of this Spyrite. For if they once begin tumultuously to ruffle and styre by sedition wytin the bodye.

The book also explains, along traditional Galenic lines, that blood is produced in the liver, called 'the shoppe of the body', and transported by the veins. Part of it ran to the heart, which enriched the liquid with *spiritus vitalis*. This was the spirit that safeguarded the sensitive functions, and was particularly associated with blood and maintained its force and power. The perfected blood that resulted, together with the *calor nativus*

<sup>27</sup> Santing C., "De menselijke canon: Het vraagstuk van de ideale mens in de Nederlandse medische wetenschap", *Bijdragen en Mededelingen voor de Geschiedenis der Nederlanden* 122 (2007) 484–502.

<sup>28</sup> Lemnius, *Touchstone* 33–34.

<sup>29</sup> For a general survey of the humours in relation to human temperaments: Arikha N., *Passions and Tempers. A History of the Humours* (New York: 2007).

<sup>30</sup> Lemnius, *Touchstone* 20–25.

or innate heat, was carried by the arteries through the whole body. The quality of this blood was determined by the degree of its mixture with the other three humours and the proportions of this concoction, as well as by food or by environmental influences such as climate, region and time of the year. While analysing the various human complexions, blood is praised as the most precious humour. Here, like most medical authors of that time, we should differentiate between blood as such – that is, the matter flowing through the arteries and veins of the human body – and blood as a distinct humour.<sup>31</sup> Lemnius also emphasises that the human blood which is discerned when a vein is opened contains all four humours. This is not to deny the fact that in the remainder of his argument he does not make such a strict distinction. Blood is considered most excellent, as it is supposed to bear the qualities of warmth and moistness. It is at its best in young people, as can be seen from their ruddy facial complexions. The excellence of the liquid was moreover demonstrated by its smooth taste, which he considered reminiscent of rice and milk. This concurs with the equation of blood and milk in devotional literature.

In order to determine the best type of human being, Lemnius deploys the notions of the *complexio* or *temperament*, bringing both terms into play. What is meant here is the balance of the qualities of hot, wet, cold and dry resulting from the mixture of elements in the human body that, in combination with the humours, was held responsible for physiological as well as psychological characteristics.<sup>32</sup> A hot and moist complexion was the best blend. As long as the blood was at its full strength and quality, the combination produced a sanguine person. Those with the purest sanguine *complexio* – Lemnius mentions as foremost examples, the Old Testament king David and the Spanish king Philip II, and makes a point of noting that Philip was also his lord – are considered to be the strongest, to have the healthiest colour, the benefit of the best balance as well as the most attractive appearance, and are mentally the most flexible. Young people or adolescents are the most typical sanguinics, but they run the risk of becoming too volatile. Growing older, although not too old, the *spiritus vitalis* becomes warmer, stronger and thus perfects a human being. By cherishing this temperament and training the accompanying strength of mind, the adult sanguinic could become rich in knowledge and experience

<sup>31</sup> Discussed in Arikha, *Passions and Tempers*.

<sup>32</sup> Siraisi N.G., *Medieval and Renaissance Medicine. An Introduction to Knowledge and Practice* (Chicago: 1990) 101–106. See for the tempers also Arikha, *Passions and Tempers*.

and achieve great wisdom. Remarkably, scarcely any attention is paid to the *spiritus animalis*, traditionally related to the brain and nerves. Instead, Lemnius concentrates on the *spiritus vitalis* that was added to the blood in the heart and, as a result, functioned as the 'fountain of life'. This is an argument for the tendency to spiritualise blood. The *spiritus vitalis* was seen to be transported by the (perfected) blood through the arteries and brought natural heat to the farthest extremities of the body. It nurtured the life force of every breathing creature. Again religious arguments are brought in, such as those from *Leviticus*. Moses' prohibition of the consumption of mammalian blood in *Leviticus* 17 is used to stress the importance of blood and to warn against its wastage. The warm arterial blood is supposed to feed life, just as the flame of a lamp burns more brightly when using good oil. A contrast is also made with the loss of blood, since it causes paleness and coldness, making it appear that the victim is dying. Blood, the conclusion goes, represents life, while loss of blood inevitably leads to death.

In his survey, Lemnius departs little from the thirteenth-century *Regimen sanitatis Salernitatum*, simply adding to it many medical, biblical and classical sources. Its verses concern dietary rules that give blood, and thus the sanguine *complexio*, a pivotal role in the life of mammals, especially of human beings, with the lines: *Consona sunt aer, sanguis, puericia verque* (Compatible are air, blood, youth and spring) and *largus, amans, hilaris, ridens, rubeique coloris, cantans, carnosus, satis audax atque benignus* (Generous, loving, joyful, merry, of ruddy complexion, singing, fleshy, rather daring, and friendly).<sup>33</sup> In addition to his appearance in many *regimina* and *practica*, the sanguinic is found extensively in courtly literature. In romances and love lyrics he is the rosy-cheeked, jovial young lover who eats red (sic!) cherries and is born under the sign of Venus and Jupiter. Sometimes he finds himself in trouble because of his volatility or his excessive sexual urges, as discussed above.<sup>34</sup> Nonetheless, the argument changes slightly here as, during the sixteenth century, the sanguinic of the Middle Ages was transformed into the ideal human being,

<sup>33</sup> Klibansky R. – Panofsky E. – Saxl F., *Saturn und Melancholie. Studien zur Geschichte der Naturphilosophie und Medizin, der Religion und der Kunst* (Frankfurt: 1992) 187; Burrow J.A., *Ages of Man. A Study in Medieval Writing and Thought* (Oxford: 1986) 18.

<sup>34</sup> Sears E., *The Ages of Man. Medieval Interpretations of the Life Cycle* (Princeton: 1986); Dove M., *The Perfect Age of Man's Life* (Cambridge: 1986); Burrow J.A., *Ages of Man*, in relation to the medical aspect, and Land K. van 't, "Een middeleeuwse James Bond: Een ideaal met schaduwkanten", *Geschiedenis Magazine* 43 (2008) 16–21.



a transformation that also brought along spiritualisation. Being already full-blooded and mature, he emerges as the resurrection of Polyclitus' and Galen's ancient *Canon*, but this time brought into a close relation with the resurrection of Christ, an event extensively discussed in Lemnius' works.<sup>35</sup> The description in his *Touchstone* echoes the criteria handed down from Antiquity, as we hear of the warm and smooth skin, comely stature, and even features such as rosy cheeks, auburn hair and a blond or red beard, as well as a perfect body shape.<sup>36</sup> To conclude, one could say that, by singing the praise of *homo sanguinicus*, the author repeated the theories of Galen and his medieval followers, but embedded these in a firm Christian framework. It is impossible here not to think of Jesus who, when crucified at the age of 32 and three months, was at the height of his capabilities in a physical as well as spiritual sense; in other words, a *homo sanguinicus*. This is clear, for example, in a painting by Lemnius' fellow countryman and contemporary, Maarten van Heemskerck [Fig. 3].

### *Blood and the heart*

The Pisan and Roman professor Andrea Cesalpino (1525–1603) discussed the function of blood in several of his learned works. These publications were directed towards an audience of medical and professorial colleagues, but at the same time show the signs of his profound Catholic, Counter-Reformation beliefs. In this third section, I will demonstrate how both fields, medicine and theology, were conflated in his concept of blood.<sup>37</sup> Cesalpino was of Tuscan origin, studying medicine at the most important university of that region, Pisa.<sup>38</sup> During his student years there, the institution experienced a Golden Age of scholarly success thanks to the presence and work of famous medical doctors such as Guido Guidi (1500–1569), an eminent authority on Hippocrates and Galen and experienced

<sup>35</sup> Lemnius, *Secrets* ch. xiv.

<sup>36</sup> Lemnius, *Touchstone* 90.

<sup>37</sup> Cesalpino's views are more elaborately discussed in my "Deus rotator and the Microrotator: Blood as the Source of Life in the Life and Works of Andrea Cesalpino" in Santing – Toubert, *Blood Symbol Liquid* 137–155.

<sup>38</sup> Ferrari A. de, "Cesalpino", in *Dizionario biografico degli Italiani* (Rome: 1980) XXIV, 122–125; Viviani U., *Vita e opere di Andrea Cesalpino* (Arezzo: 1922); Colombero C., "Pensiero filosofico di Andrea A. Cesalpino", *Rivista critica di storia della filosofia* 32 (1977) 269–284 and Bylebyl J.J., "Cesalpino and Harvey on the Portal Circulation" in Debus A.G. (ed.), *Science, Medicine, and Society in the Renaissance. Essays to honour Walter Pagel* (New York: 1972) 39–52.



Fig. 3. Maarten van Heemskerck, *Christ crowned with thorns*, ca. 1550/1555.

anatomist, the botanist Luca Ghini (1490–1556), and the anatomists Realdo Colombo (1516–1559) and Gabriele Fallopio (1523–1562).<sup>39</sup> Colombo in particular must have exerted a major influence on Cesalpino in several respects. He set an example by exchanging Pisa and Padua for Rome, trying his luck at the more rewarding as well as more lucrative papal court. Cesalpino would likewise find himself in the Eternal City in the latter part of his career, in the capacity of papal physician. Colombo is still known for his discovery of the so-called ‘pulmonary or lesser circulation of blood’, demonstrating that all the blood goes from the right ventricle of the heart through the lungs before returning to the left ventricle.<sup>40</sup> This breakthrough disproved Galen’s idea that blood passed from the right to the left ventricle through minute pores in the *septum*, the dividing wall between the two ventricles of the heart. It is possible that Colombo and his Romano-Spanish pupil Juan Valverde d’Amusco might have built these findings on Michael Servetus’ (1511–1553) work *Christianismi restitutio* (1553), a treatise that was confiscated by the Inquisition. Undeniably, Servetus’ ideas on blood and its function within a system of unified body and soul bear a clear resemblance to those of Colombo and Cesalpino.<sup>41</sup>

While living and working in Rome, Cesalpino’s deep religiosity not only made him a reliable physician to popes and cardinals, but his convictions equally drove him into the arms of the Roman Counter-Reformation religious leader Filippo Neri and his Oratory.<sup>42</sup> All of these factors had a profound influence on his medical views, leading him to accommodate them to Catholic doctrine and practice. In their high tone, Cesalpino’s medical works resemble those of Andreas Vesalius and in turn those of the common adversary of both of them, Galen. Nonetheless, he by no means envisioned himself as an innovator, which had been an image Vesalius had to some extent cherished. On the contrary, in line with the spirit of

<sup>39</sup> Grendler P., *The Universities of the Italian Renaissance* (Baltimore: 2002) 70–77.

<sup>40</sup> There are no comprehensive publications on Colombo. See: Bylebyl J.J., “Realdo Colombo”, in Gillespie C.C. (ed.), *Dictionary of Scientific Biography* (New York: 1973) viii, 354–357; Moes R.J. – O’Malley C.D., “Realdo Colombo: On those Things rarely found in Anatomy, an Annotated Translation from the *De re anatomica* (1559)”, *Bulletin for the History of Medicine* 34 (1960) 508–528 and Cunningham, *Anatomical Renaissance* 143–166.

<sup>41</sup> For a summary of this discussion see Mason S., “Religious Reform and the Pulmonary Transit of the Blood”, *History of Science* 41 (2003) 459–471.

<sup>42</sup> See Santing C., “*De affectibus cordis et palpitacione* – Secrets of the Heart in Counter-Reformation Italy” in Blecourt W. de – Osborne C. (eds.), *Cultural Approaches to the History of Medicine. Mediating Medicine in Early Modern and Modern Europe* (Basingstoke: 2003) 10–35 and Toubert J.J., *Emblemen van lijdzaamheid. Recht, geneeskunde en techniek in het hagiografische werk van Antonio Gallonio (1556–1605)* (Groningen: 2009).



the Counter-Reformation, which aimed to return to the time of the Early Church in Antiquity, he wholeheartedly embraced Aristotle. This preference for the Greek philosopher deepened when, in the course of the sixteenth century, the papacy, together with leading theologians, often members of newly established orders, came to reaffirm the ties between Catholicism and Aristotelianism.<sup>43</sup> Cesalpino's constant disapproval of Galen who, as we have seen above with regard to Lemnius, was still extremely popular, is also connected to the realisation of Aristotle's research programme in the sixteenth century.<sup>44</sup> In pleading his case, Cesalpino moved from what might be called a *prisca medicina* towards a synthesis of faith and reason. In this Aristotelian *medicina theologica*, that was also influenced by the works of Marsilio Ficino, blood and the heart played the leading roles, while God functioned as the one and only constituent cause of all things.<sup>45</sup> In this regard, Cesalpino once used the term *deus rotator* to describe the work of God, suggesting that he valued the heart as God's counterpart, as some kind of 'microrotator' (my term).

Before discussing further Cesalpino's considerations on blood, it is important to state again that in the sixteenth century several types of blood were distinguished, and he was very conscious of all of the subtle distinctions between them. The first type was the bodily fluid, forming part of the humoral system, which had its origin in the liver. Ingested food, transformed by the stomach into chyle, was transported to the liver, where it was heated to become blood. The two types of bile originated in the same organ. The fluid to be found in the veins was considered to be a sanguineous mass consisting of a mixture of pure blood with a lesser proportion of the other three humours. However, Cesalpino's interest mainly lay in the second type of blood. This was a concoction that combined blood and spirit, the latter drawn by the lungs from the air and brought into the heart. He sometimes calls this 'perfected' or 'matured' blood.

---

<sup>43</sup> See for example, Grendler, *Italian Universities* 309 and Cunningham, *Anatomical Renaissance*.

<sup>44</sup> Cunningham A., "Fabricius and the 'Aristotle Project' in Anatomical Teaching and Research at Padua", in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 195–222 and idem, *Anatomical Renaissance*.

<sup>45</sup> On the intricacies of Christian Platonism in this respect see Mulsow M., "The Ambiguities of the *Prisca Sapientia* in Late Renaissance Humanism", *Journal of the History of Ideas* 65 (2004) 1–13, who discusses Cesalpino's counterpart Francesco Patrizi and his *Discussiones Peripateticæ* (Venice, Giunta: 1571). This combination of Aristotelianism with (Neo)Platonic influences is also to be met in Melanchthon: Frank G., "Melanchthon and the Tradition of Neoplatonism", in Helm J. – Winkelmann A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001) 3–18.

The resulting mixture formed the vehicle of the *spiritus vitalis* that followed its course through the body via the arteries. In addition to the perfected blood, the *virtus vitalis* is a crucial element in Cesalpino's discourse. This is the faculty present in man that guaranteed the existence of the vital spirit and therefore was a crucial element in the principle of life. Having its foundations in the heart, it manifested itself via heartbeat, pulse and respiration. The associated organs were those of the thoracic cavity and the arteries, with the heart at the centre.<sup>46</sup>

The fifth book of his *Questiones peripateticarum* discusses biological and physiological topics.<sup>47</sup> Tellingly, the point of departure is the unity of the human body, which is safeguarded by the soul. Galen and Plato, with their notion of a triple soul, are fiercely denounced, leading to a discussion of the different parts of the soul and the disparities between the various species. Creatures which have a heart, and thus live because they have blood, are professed to belong to the most perfect class. The explanation for this is that the heart is proclaimed to be the first organ to be formed in the foetus and the last to die, an argument borrowed from Aristotle's *De partibus animalium*.<sup>48</sup> Cesalpino states that without this organ all other parts of the human body are merely 'dead hands' or 'dead eyes'. Contrary to the brain or the liver, which can function with minor blemishes, here not the slightest loss of quality can be tolerated; every tear proves fatal. Therefore, for Cesalpino the heart is the origin of all corporeal operation; out of affection for it every other organ follows its lead, as with the cardiac pulsations, for example.

The superiority of the heart is given a fourfold Aristotelian grounding. First, of course, is its position at the centre, being the best location for the even distribution of life through the body. Obviously, 'at the centre' suggests all kinds of other, non-medical references to perfection and the ideal. According to Cesalpino, the most important argument for the

---

<sup>46</sup> The sixteenth-century discussion is explained by Bylebyl J.J., "Disputation and Description in the Renaissance Pulse Controversy" in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 223–244. For a brief description of the physiological system concerning virtues, faculties, spirits, etc., see Siraisi, *Medieval and Renaissance Medicine*, ch. iv.

<sup>47</sup> *Quaestionum peripateticarum libri V*. The first edition was published in 1571, the second in 1593. The translation of most parts of the five books with an introduction to his philosophy was carried out by Dorolle M., *Césalpin Questions Péripatéticiens* (Paris: 1929). For Book V, 4 Clark M.E. – Minis S.A. – Rochefort G., "Andreas Cesalpino, 'Quaestionum peripateticarum', libri v, liber v, quaestio IV", *Journal of the History of Medicine and Allied Sciences* 33 (1978) 185–213.

<sup>48</sup> Arist. *PA* 3.4.

primacy of the heart is that it contains and maintains the warmth of the soul, the *virtus vitalis*. All other organs acquire their warmth from it. This interpretation brings him to the arteries and veins. They are also bound to have their origin in the heart, where the heat produces blood, the supreme nourishment, which is to be dispersed throughout the body by the arteries and brought back to its origin by the veins. Here, Cesalpino also compares the arteries with rivulets drawing their fluid from a source, but at the same time emphasises that veins and arteries form a single, uninterrupted, system. Even the nerves form part of this completely interconnected transit system, being viewed as the finest ends of the capillaries of the aorta.<sup>49</sup> Thus, blood – that is, perfected blood – is declared the supreme nourishment and the concoction that engenders the growth and maturation of all creatures. As such, it must emerge from the source of heat: the heart. This interpretation is based on the observation that after conception the very early foetus looks like a bloody clot.

Subsequently, the author feels compelled to elucidate the movement of blood through the body. To begin with, the Galenic idea about veins and arteries with their separate tasks is denounced in favour of the unified Aristotelian system. The problems with the precise details of Cesalpino's ideas in this context are widely discussed in the literature, but the system he sketches is still very confusing. For the purposes of my argument here, it is enough to know that in the right ventricle of the heart the richest and warmest blood was found, whereas the purest and freshest blood was found in the left ventricle. The former's function was supposed to be sustenance, distributed via the *vena cava*. The latter's task was maintaining and maturing the body's form through the *aorta*. Ultimately, the pure fresh blood ascended from the heart towards the brain, and as such this fine and pure matter generated the sensations, which otherwise would be far too unsubtle and even coarse. One could say that blood was thought to be refined a further time in the brain. The excess warmth was regarded as being cooled by the humidity and low temperature of the brain. Again, this was done best in human beings, as they had the most blood and most heat at their disposal and also had the largest brains.

In the eyes of Cesalpino, the pulsation of the heart and the arteries was the result of the boiling of the humour of blood in the heart; that is, the creation of perfected blood, mentioned above. This is logical, he says,

---

<sup>49</sup> All to be found in *Questiones*, book 5, question III, "That the heart is not only the principle of the arteries, but also of the nerves."

since pulsations also occur in other fluids that are boiled. To achieve this, the heart and the vessels swell up. This contradicts Galen, who claimed that there was an alternating pulsation in the heart and arteries and also established that there was a relationship between respiration and the cooling of blood. Cesalpino, however, asserts that 'all the arteries with the heart, moreover, are like a kind of whole, for they form a continuous vessel of pure blood'.<sup>50</sup> In his view, nourishment of the parts of the body occurs via the continuous generation of blood in the heart. The blood pulses strongly in the arteries because of the spirit they carry through the body. This reasoning brings Cesalpino to his description of the blood's movement. Here he makes a meticulous distinction between the arteries and veins and seems to have a clear idea of the position and function of the valves, which secure a very specific path for the blood: 'from the veins into the heart while the heat [of the heart] is drawing nourishment from the heart into the arteries'.<sup>51</sup> For Cesalpino, this nourishment is the spirit prepared by the warmth in the heart and dispersed by arterial blood. To maintain this warmth, nature had placed the heart at the centre of the body and took care to protect it with the pericardium. The cooling process is said to occur in the lungs, described more or less in accordance with the opinion of his teacher Colombo, except for the remarks on the anastomosis, where he still leaves some space for the movement of blood through septal pores:

[...] The lung, then, draws warm blood through the veinlike artery [*vena arterialis*] from the right ventricle of the heart and returns it through anastomosis to the *arteria venalis*, which enters the left ventricle of the heart. In the meantime there is cooling only by contact with the cool air transmitted through the canals of the windpipe, which spread out next to the *arteria venalis*, but do not communicate by openings, as Galen thought. Dissection corroborates this circulation of blood from the right ventricle through the lungs and to the left ventricle of the same.<sup>52</sup>

In the first lines of his handbook, *Ars medica* (1602–1603), Cesalpino enlightens us as to the general principles of healing and the constitution of the human body [Fig. 4].<sup>53</sup> Human beings are immediately characterised as *mundus parvus* and likened to creation as a whole. Here, the views on blood do not deviate from those expressed in the much older *Questiones*,

<sup>50</sup> Clark – Nimis – Rochefort, "Cesalpino" 197.

<sup>51</sup> Clark – Nimis – Rochefort, "Cesalpino" 199.

<sup>52</sup> Clark – Nimis – Rochefort, "Cesalpino" 209.

<sup>53</sup> Cesalpino Andrea, *Ars medica* (Rome, Aloysius Zanettus: 1602–1603).

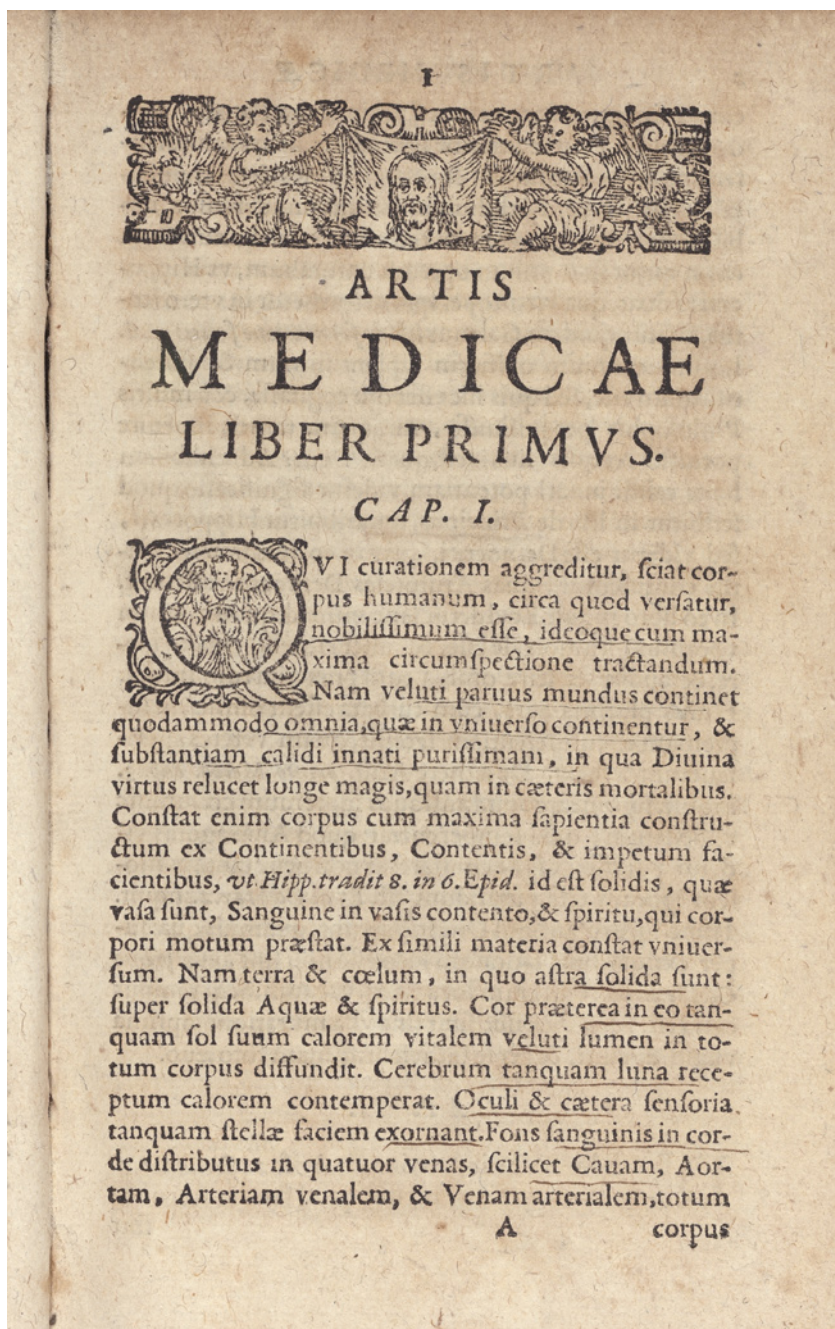


Fig. 4. Beginning of the first book of Andrea Cesalpino's handbook *Ars medica* with an image of the Vera Icon in the top margin.



but his Christian world-view, not to say 'body view', seems to have developed after his arrival in Rome. In the capacity of a 'little world', the author maintained, everything the human body contains was also to be found in the universe. Its most precious matter and purest substance was the *calor innatus* or innate heat, in which the divine virtue was far brighter than in any other mortal matter. Hence, the body is considered to be divinely constructed, with ultimate wisdom and as an uninterrupted whole, as a container in which blood procured spirit throughout the body. The source of this blood, he says, lies in the heart and thus this organ is the most important to human beings. He compares it with the sun and its rays, but also with God and the Holy Spirit. The biblical reference is unmistakable, with the four veins – (*Vena*) *Cava*, *Aorta*, *Arteria venalis* and *Vena arterialis* – that distribute the blood likened to the four rivers springing from Paradise.

In conclusion, one could say that Cesalpino's natural philosophy focuses on the centre of life and aims to investigate its secrets. In his *Questiones* he concludes: 'The heart is like a flame effecting the heating of blood and continual generation of spirit', which sounds very much like Lemnius. Although in his *Ars medica* he carefully distinguished the role of the doctor from that of God, it is obvious that he judges the truths of Christianity to be revealed in the human body, its fabrication and workings. His views on the heart and blood, and therefore his fervent denial of Galen, must have been religiously motivated. The fact of the matter is that Aristotle's preference for the heart as the ruling part of the body is in line with the doctor's devotional inclinations. The circulation of blood was a refuelling procedure which fed the body and distributed warmth. The perfected blood and the heart's faculty, *spiritus*, become equivalents of the Holy Spirit and its divine fervour.

### *The s/Spirit of blood*

The study of blood is a many-voiced enterprise. In premodern times the unravelling of its secrets was of a mixed, that is, philosophical, medical and religious, nature and I hope to have demonstrated that blood was seen as precious in several of the discourses then current. Each genre, of course, adhered to its disciplinary practices, but the incentives steering its authors cannot be labelled unequivocally religious, philosophical or medical. The essence of the problem is that as a material substance blood was still valued as so very precious that it paradoxically tended to lose its

materiality and take on spiritual aspects, which made devotional associations inevitable. Caroline Walker Bynum was completely correct to point to the non-corporeal aspects of blood, associating it with God, especially with the Holy Spirit and its terrestrial emanation. No matter how they exploited Aristotle, as well as Galen, a spiritualisation of blood was also at stake in the works of Lemnius and Cesalpino and, for instance, that of Paracelsus too, although there is no room here to discuss his 'Spiritualist reform of medicine'.<sup>54</sup> In his extensive *regimina*, the more traditional Levinus Lemnius emphasised the *spiritus vitalis* that determined the quality of blood. At its finest stage, it approached the *spiritus universalis* almost converging with the Holy Spirit. Likewise the Aristotelian Cesalpino placed the heart and the spiritualised human fuel blood again and again at the centre, bringing everything back to its origin, God: the *deus rotator*.

---

<sup>54</sup> Cunningham, *Anatomical Renaissance* 236–247.



### Selective bibliography

- ARCIERI J.P., *The Circulation of Blood and Andrea Cesalpino of Arezzo* (New York: 1945).
- ARIKHA N., *Passions and Tempers. A History of the Humours* (New York: 2007).
- BILDHAUER B., *Medieval Blood* (Cardiff: 2006).
- BURROW J.A., *The Ages of Man. A Study in Medieval Writing and Thought* (Oxford: 1986).
- BYLEBYL J., "Cesalpino and Harvey on the Portal Circulation", in Debus A.G., *Science, Medicine, and Society in the Renaissance. Essays to Honour Walter Pagel* (New York: 1972) 39–52.
- BYNUM WALKER C., *Wonderful Blood. Theology and Practice in Late Medieval Northern Germany and Beyond* (Philadelphia: 2007).
- CAMPORISI P., *Il sugo della vita. Simbolismo e magia del sangue* (Milan: 1984) [English translation: *Juice of Life. The Symbolic and Magic Significance of Blood*, tr. Barr R. (New York: 1995)].
- CESALPINO ANDREA, *Ars medica* (Rome, Aloysius Zanettus: 1602–1603).
- , *Peripateticarum quaestionum, libri quinque* (Venice, Giunta: 1571).
- CLARK S. – NIMIS S.A. – ROCHEFORT C., "Andreas Cesalpino, "Quaestionum peripateticarum", libri v, quaestio IV", *Journal of the History of Medicine and Allied Sciences* 33 (1978) 185–213.
- COLOMBERO C., "Pensiero filosofico di Andrea A. Cesalpino", *Rivista critica di storia della filosofia* 32 (1977) 269–284.
- CUNNINGHAM A., "Fabricius and the 'Aristotle Project' in Anatomical Teaching and Research at Padua", in Wear A. – French R.K. – Lonie I.M. (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge: 1985) 195–222.
- , "Sir Thomas Browne and his *Religio Medici*: Reason, Nature and Religion", in Cunningham A. – Grell O.P. (eds.), *Medicine and Religion in Seventeenth-Century England* (Aldershot: 1997) 12–55.
- , *The Anatomical Renaissance. The Resurrection of the Anatomical Projects of the Ancients, Part II An Anatomical Reformation* (Aldershot: 1997).
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.
- CUNNINGHAM A. – GRELL, O.P. (eds.), *Medicine and Religion in Seventeenth-Century England* (Aldershot: 1997) 12–55.
- DOROLLE M., *Césalpin, Questions péripatéticiens* (Paris: 1929).
- DOVE M., *The Perfect Age of Man's Life* (Cambridge: 1986).
- FEHER M., *Changing Tools. Case Studies in the History of Scientific Methodology* (Budapest: 1995).
- FERRARI A., "Cesalpino, Andrea", in *Dizionario biografico degli Italiani* (Rome: 1980) 24, 122–125.
- FORRESTER J. tr/ann., *The Physiologia of Jean Fernel* (Philadelphia: 2003).
- FRANK G., "Melanchthon and the Tradition of Neoplatonism", in Helm J. – Winkelmann A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001) 3–18.
- GRENDLER P., *The Universities of the Italian Renaissance* (Baltimore: 2002).
- HELM J., "Religion and Medicine: Anatomical Education at Wittenberg and Ingolstadt", in Helm J. – Winkelmann A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001) 51–68.

- HELM J. – WINKELMANN A. (eds.), *Religious Confessions and the Sciences in the Sixteenth Century* (Leiden: 2001).
- HOORN C.M. VAN, *Levinus Lemnius 1505–1568. Zestiende-eeuws Zeeuws geneesheer* (Kloostorzande: 1978).
- INFESSURA S., *Diario della città di Roma di Stefano Infessura scriba senato. Nuova edizione a cura di Oreste Tommasini* (Rome: 1890).
- KLIBANSKY R. – PANOFKY E. – SAXL F., *Saturn und Melancholie. Studien zur Geschichte der Naturphilosophie und Medizin, der Religion und der Kunst* (Frankfurt: 1992).
- LAND K. VAN 'T, "Een middeleeuwse James Bond: Een ideaal met schaduwkanten", *Geschiedenis Magazine* 43 (2008) 16–21.
- LEMNIUS LEVINUS, *De habitu et constitutione corporis, quam Graeci Κρᾶσιν, Triviales complexionem vocant, Libr. II.* (Antwerp, Guilielmus Simonis: 1561).
- , *De occultis naturae miraculis libr. II* (Antwerp, Guilielmus Simonis: 1559).
- , *Herbarum atque arborum quae in Bibliis passim obviae sunt* (Antwerp, Guilielmus Simonis: 1564).
- , *Similitudinvm ac parabolarum, quae in bibliis ex herbis atque arboribus desumuntur, dilucida explicatio* (Antwerp, Guilielmus Simonis: 1568).
- , *The Secret Miracles of Nature. In Four Books. Learnedly and moderately Treating of Generation, and the Parts thereof, the Soul, and its Immortality, of Plants and Living Creatures, of Diseases, their Symptoms and Cures, and Many Other rarities [...] Whereunto is added one book containing philosophical and Prudential Rules how Man shall become Excellent in all Conditions, whether high or low, and lead his Life with Health of Body and Mind* (London, Jo. Streater and Humphrey Moseley: 1658).
- , *The Touchstone of Complexions. Expedient and Profitable for All such as bee Desirous and Carefull of their bodily Health. Contayning most Ready Tokens, whereby every one may perfectly try, and thorowly know, as well the Exact State, Habit, Disposition, and Institution of his Body outwardly. As also the Inclinations, Affections, Motions, and Desires of his Minde inwardly* (London, Jo. Streater and Humphrey Moseley: 1633).
- MASON S., "Religious Reform and the Pulmonary Transit of the Blood", *History of Science* 41 (2003) 459–471.
- MOES R.J. – O'MALLEY C.D., "Realdo Colombo: On those Things rarely found in Anatomy, an Annotated Translation from the *De re anatomica* (1559)", *Bulletin for the History of Medicine* 34 (1960) 508–528.
- MULSOW M., "The Ambiguities of the *Prisca Sapientia* in Late Renaissance Humanism", *Journal of the History of Ideas* 65 (2004) 1–13.
- PAGEL W., "The Claim of Cesalpino and the First and Second Editions of his 'Peripatetic Questions'", *History of Science* 13 (1975) 130–138.
- , *William Harvey's Biological Ideas* (New York: 1967).
- PICCINI S., *Andrea Cesalpino scopritore, William Harvey promulgatore della circolazione sanguigna* (Milan: 1963).
- REUSCH FR.H., *Der Index der verbotenen Bücher ein Beitrag zur Kirchen- und Literaturgeschichte* (Bonn: 1883).
- RUBIN M., *Corpus Christi. The Eucharist in Late Medieval Culture* (Cambridge: 1991).
- SANTING C., "De affectibus cordis et palpitatione – Secrets of the Heart in Counter-Reformation Italy", in Blecourt W. de – Osborne C. (eds.), *Cultural Approaches to the History of Medicine. Mediating Medicine in Early Modern and Modern Europe* (Basingstoke: 2003) 10–35.
- , "De menselijke canon: Het vraagstuk van de ideale mens in de Nederlandse medische wetenschap", *Bijdragen en Mededelingen voor de Geschiedenis der Nederlanden* 122 (2007) 484–502.
- SANTING C. – TOUBER J. (eds.), *Blood Symbol Liquid* (Louvain: 2011).
- SEARS E., *The Ages of Man. Medieval Interpretations of the Life Cycle* (Princeton: 1986).
- SIRAISSI N.G., "Life Sciences and Medicine in the Renaissance World", in Grafton A. (ed.), *Rome Reborn. The Vatican Library & Renaissance Culture* (Washington: 1993) 169–198.

- , *Medieval and Renaissance Medicine. An Introduction to Knowledge and Practice* (Chicago: 1990).
- , “Signs and Evidence: Autopsy and Sanctity in Late Sixteenth-Century Italy”, in Siraisi N.G. (ed.), *Medicine and the Italian Universities, 1250–1600* (Leiden: 2001) 356–380.
- SLACK P., “Mirrors of Health and Treasures of Poor Men: The Uses of the Vernacular Medical Literature of Tudor England”, in Webster Ch. (ed.), *Health, Medicine and Mortality in the Sixteenth Century* (Cambridge: 1979) 237–242.
- TOUBER J.J., *Emblemen van lijdzaamheid. Recht, geneeskunde en techniek in het hagiografische werk van Antonio Gallonio (1556–1605)* (Groningen: 2009).
- VIVIANI U., *Vita e opere dii Andrea Cesalpino* (Arezzo: 1922).



WHITE BLOOD AND RED MILK.  
ANALOGICAL REASONING IN MEDICAL PRACTICE  
AND EXPERIMENTAL PHYSIOLOGY (1560–1730)

Barbara Orland

*Summary*

In early modern physiological thinking, analogies between different parts of the body played an essential role in understanding the hidden workings inside the living body. One very old and widely used example of this style of reasoning is the analogy between blood and milk. The aim of this article is to investigate this analogy in two ways: first, by describing how the analogy was embodied in medical practices for dealing with women's generative capacities. Second, historicisation of the analogy will serve as a guide to understanding changing conceptions of blood and milk formation within the emerging fields of experimental physiology. The epistemic tool of the blood-milk analogy, it will be argued, managed to survive the shift from a humoral to a hydraulic body concept but acquired an interesting new meaning. Within a hydromechanical theory of nutrition, blood came to be more explicitly equated with 'red milk', while 'milk' was set in a new relation to 'white chyle'.

*Introduction. Body, matter and analogy*

'If we would define or describe what Milk is, it seemeth to be nothing but white blood', wrote the English physician and naturalist Thomas Moffett (1553–1604) in his dietetic rules for a healthy body.<sup>1</sup> 'If one examines blood somewhat more closely, one will detect that it is almost nothing but milk [...] milk, just slightly coloured', Dutch physician Cornelis Bontekoe (1647–1685) pointed out in his popular book on *Life, Health, Illness and Death* from 1685.<sup>2</sup> Far more than just metaphorical views on two eminent

---

<sup>1</sup> Moffett Thomas, *Healths Improvement. Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of food used in this nation, corrected and enlarged by Christopher Bennet* (London, Newcomb for Samuel Thomson: 1655) 119–120 (Orig. written ca. 1595).

<sup>2</sup> 'Wenn man nun das Blut was näher untersucht | so wird man befinden | daß es bey nahe schier nichts denn Milch ist [...] Milch | ein wenig gefärbet'. Bontekoe Cornelis, *Kurtze Abhandlung von dem Menschlichen Leben/ Gesundheit/ Kranckheit und Tod/ In Drey*

body substances, these references to milk as 'white blood' and to blood as 'red milk' were part of a heritage from the ancients that was handed down to modern physiology until the turn of the nineteenth century. Nurtured and fostered through philosophical debates as well as daily routines in medicine and everyday life, comparing the two fluids was a common practice. These two phrases expressed longstanding and widespread assumptions about generative and nutritive processes inside a humoral body.

Historians recently have argued that the 'humoral body' was the fundamental conception of the self in the Early Modern period. In the words of Gail Kern Paster, 'whenever the early modern subject became aware of her or his body [...] the body in question was always a humoral entity'.<sup>3</sup> Yet humoral, as has been shown by these studies, referred not only to the canonical four humours of Galenic physiology: blood, phlegm, yellow bile, and black bile (and, concomitantly, the awareness of the four elements or qualities hot, cold, wet, and dry). The experience of the humoral body included many other fluids. Together with the solid parts they formed a humid and vaporous body, in which organs played a subordinated role.

Placing emphasis on the fluidity of the body had epistemic consequences. Whether the sensory mode of knowing oneself, the definition of health or the medical diagnosis and pharmacological treatment of the sick person, all knowledge patterns and bodily practices were based on the idea that the human constitution could be known from the fluids.<sup>4</sup> Permeability was also observed in the solid parts of the body, which most often were evaluated as fundamental parts of a continuous flow system. Organs as a collection of containers for liquids accomplished the specific task of the delicate balancing of fluids that was indispensable for mental and physical health. With natural evacuations on the one side and artificial manipulations like blood letting, reduced diet, or overindulgence in food on the other, the humoral body constantly changed its shape. The term 'humoral' was thus employed with a wide range of meanings. It could signify material states, qualities, or individual dispositions that

---

*unterschiedenen Theylen verfasst/ Davon das I. Unterricht giebet von dem Leibe [...]. II. Von der Kranckheit/ und derselben Ursachen. III Von denen Mitteln/ das Leben und die Gesundheit zu unterhalten und zu verlängern [...]* (Bautzen Rudolstadt, F. Arnst and Joh. Rudolph Löwe: 1692) 32 (Orig. written in Dutch 1684).

<sup>3</sup> Paster G.K., *The Body embarrassed. Drama and the Disciplines of Shame in Early Modern England* (Ithaca, NY: 1993) 10.

<sup>4</sup> The practical examination of urine was one of the most important tools of early modern medical diagnosis. Cf. Stolberg M., *Die Harnschau. Eine Kultur- und Alltagsgeschichte* (Cologne etc.: 2009).

were the result of an inherent composition of the body influenced by its environment. Once again in the words of Gail Kern Paster: 'we fail to recognise how the porous and volatile humoral body, with its faulty borders and penetrable stuff, interacts differently with the world than the 'static, solid' modern bodily container'.<sup>5</sup>

In the face of such unstable bodies, the comparison of two empirical fluids could help to understand and communicate the uncertainties of the body. As the quotations of Moffett and Bontekoe illustrate, the authors presumed similarities between blood and milk, but they did not expect a material identity or consider the two fluids to be physiologically homologous substances. In particular their use of the metaphors of 'white blood' and 'red milk' makes clear that the analogy reflected far more than sensory evidence. Instead the authors anticipated an identity of relation between two different fluids. To them the metaphors were pieces of knowledge that illuminated the complex theory of the formation and functioning of the humours. Their analogical reasoning referred to a theoretical object, a theory that encompasses ideas about the hidden workings of the body. What then is the relationship between blood and milk? How did the community of learned physicians study this relationship, and why?

For a long time, the history of the humoral theory has attracted the attention of historians. Yet until now there has been little interest in the epistemological tools that constituted the mode of knowledge production in physiology and medical practice. Recent scholars interested in studying the history of the humoral body have confined themselves mostly to the construction of individual subjectivity and emotional life as it was expressed in different literary sources (e.g. the plays of Shakespeare).<sup>6</sup> An older historiographical tradition has described humoral thinking as the outcome of the long-standing Hippocratic-Galenic tradition in early modern medicine.<sup>7</sup> Only a few historians have started to investigate humoral theory as an immediate knowledge that guided medical experts as well as lay people in their understanding of the hidden functionings of the

---

<sup>5</sup> Paster G.K., *Humoring the Body. Emotions and the Shakespearean Sage* (Chicago: 2004) 23.

<sup>6</sup> In addition to Paster see also Schoenfeldt M.C., *Bodies and Selves in Early Modern England. Physiology and Inwardness in Spenser, Shakespeare, Herbert, and Milton* (Cambridge etc.: 1999).

<sup>7</sup> Of the many relevant works see for example Wear A., *Knowledge and Practice in English medicine, 1550–1680* (Cambridge etc.: 2000); Siraisi N.G., *Medieval and Early Renaissance Medicine. An Introduction to Knowledge and Practice* (Chicago, Il. etc.: 1990); Nutton V., *Ancient Medicine* (London: 2004).



invisible body.<sup>8</sup> One of the most inspiring but also controversial studies which emphasised the historical contingency of the humoral physiology was Thomas Laqueur's *Making Sex*. Laqueur called for a rethinking of the notion of the humoral body in terms of a 'physiology of fungible fluids and corporeal flux'. He explained this shift like this: 'Endless mutations, a cacophonous ringing of changes, become possible where modern physiology would see distinct and often sexually specific entities'.<sup>9</sup> But what precisely does it mean if bodily fluids like blood, semen, sweat, tears, or milk turned into one another and hence were 'entirely fungible'? What kind of mutations were at work? Laqueur's concern was the humoral similarity between male and female bodies, and not the history of transformations of bodily matter. Although he mentioned the coming into being of milk from blood, some of his formulations nevertheless suggest that the unfixed boundaries of sex had a material expression in unfixed liquids. This can however be misunderstood, because it implies the physiological replaceability of different substances.

Early modern authors did not think that way; bodily fluids obviously were not entirely fungible. Whether in scientific or in popular writings, the authors were quite unambiguous concerning the fundamental ontological make-up of bodily fluids. Bontekoe had no doubt about the true 'nature' of both fluids in the sense that they had a regularly recurring appearance. One could identify the fluid for what it is: blood was blood and milk was milk.<sup>10</sup> Nevertheless, the physical identity as it was accessible to the senses was unstable, because persisting substances always differ with respect to their momentary stages. Sensual experiences therefore had to be complemented by the wisdom and knowledge of practice, reason and tradition, not least with reference to the Bible and the theories of the ancient philosophers. In this respect, most early modern authors would have agreed that variations existed by nature. Blood and milk could not always be the same, because everybody had his or her distinctive *complexion* (in the sense of

---

<sup>8</sup> Cf. Duden B., *The Woman beneath the Skin. A Doctor's Patients in Eighteenth-Century Germany* (Cambridge, Mass.: 1991); Stolberg M., *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (Cologne etc.: 2003); Arikha N., *Passions and Tempers. A History of the Humours* (New York: 2007).

<sup>9</sup> Laqueur T. *Making Sex. Body and Gender from the Greeks to Freud* (Cambridge, Mass.-London: 1990) 35.

<sup>10</sup> 'Aber gleichwie die Milch weiß ist | so ist das Blut roth | und wie dieses roth ist | so ist die Gall alleine der Safft | welcher dunckel-gelbe ist; Der Urin hergegen ist lichte | und als Citron-gelbe'. Bontekoe, *Kurtze Abhandlung* 33.

make-up).<sup>11</sup> The nature of a woman differs from that of a man; the *physis* of a child is unlike that of an adult. The material substance of a strong body differs from that of a weak one, and so on. Like every other part of the body, a body's blood and milk acquired their material imprint at the moment of conception, while external influences (the 'six non-naturals') had a constant impact through life. Therefore it is not surprising to find a philosopher debating the quality of cow's milk according to age, season, and weather. The British polyhistor and philosopher Thomas Browne (1605–1682) declared in his section on coagulation, one has 'to know the differences of milk in several seasons'. When cows give birth to a calf in the spring, their milk grows thick around Christmas.<sup>12</sup>

Furthermore, there could be qualitative differences in bodily fluids that were completely impossible to explain on the basis of sensory perceptions. In this respect, common sense would have argued that the material changes and transformations necessary to sustain life happen due to the workings inside the body. To Johann Storch (1681–1751), the town physician of Eisenach in the 1730s, the inside was 'a place of metamorphosis', as Barbara Duden has put it.<sup>13</sup> Because these inner metamorphoses could not be perceived with the senses, philosophers as well as medical practitioners needed knowledge tools that provided at least indirect experience. The constraints and limitations of the information obtained from anatomical dissection lay in the rapid drying-out of the dissected dead body. This problem, which was already explicit in the mind of ancient anatomists, was posed anew by experimental physiologists during the Early Modern period. Gaining knowledge from the living body remained one of the biggest challenges of anatomy.<sup>14</sup> The study of fluids and flows that could be observed externally therefore was indispensable in order to understand the hidden make-up of the humoral body. As will be argued in the following, the comparison of blood and milk must be viewed as an outcome of this age-old problem of medicine.

This paper will begin by examining the medical perspectives on generative processes inside the female body that made use of the analogy

<sup>11</sup> A detailed explanation of the early modern concept of *complexion* is offered by Groebner V., "Complexio/Complexion: Categorizing Individual Natures 1250–1600", in Daston L. – Vidal F. (eds.), *The Moral Authority of Nature* (London: 2004) 361–383.

<sup>12</sup> Wilkin S. (ed.), *Sir Thomas Browne's Works. Including his Life and Correspondence* (London: 1835), vol. 4, 430–431.

<sup>13</sup> Duden, *The Woman beneath the Skin* 109.

<sup>14</sup> Cf. Maehle A.H. – Troehler U., "Animal Experimentation from Antiquity to the End of the Eighteenth Century: Attitudes and Arguments" in Rupke N.A. (ed.), *Vivisection in Historical Perspective* (London-New York: 1990) 14–47.

between blood and milk. Bodily signs had enormous importance in the diagnosis and prognosis of the state of health of an individual body, its illnesses and necessary treatments. But physiological knowledge, as part of medical theory, was based to a similar extent on comparative anatomy and analogical reasoning. As will be shown in the second part of the paper, the functions of nutrition in general and, more concretely, of embryonic nutrition, were reflected with regard to the blood-milk-analogy as well. All of the most important schools of physiological theory, whether the Aristotelian-Galenic school, the iatrochemical that originated with Paracelsus, or the iatromechanical that started with Descartes, made use of it.<sup>15</sup> But although descriptions of the inner workings of the body changed rapidly once scientists used new experimental technology, relational representations of blood and milk remained practically feasible for the physiological understanding of metabolic processes.

### *Menstruation and lactation*

‘[...] [W]e commonly come to say the fetus is nourished and milk is generated from the menstrual blood’.<sup>16</sup> When medical textbooks of the Early Modern period referred to the child-bearing capacity of women and female animals, then they introduced the blood-milk analogy for obvious reasons. Lactating women usually do not menstruate.<sup>17</sup> Pregnancy stops the menses,

---

<sup>15</sup> See for example Davis A.B., *Circulation Physiology and Medical Chemistry in England (1650–1680)* (Lawrence, Kansas: 1973); Brown T.M., *The Mechanical Philosophy and the ‘Animal Oeconomy’. A Study in the Development of English Physiology in the Seventeenth and Early Eighteenth Centuries* (New York: 1981); Roger J., *The Life Sciences in Eighteenth-Century French Thought* (Stanford, CA: 1997); Smith J.E.H., *The Problem of Animal Generation in Early Modern Philosophy* (Cambridge: 2006).

<sup>16</sup> Forrester J., *The Physiologia of Jean Fernel (1567)* (Philadelphia: 2003) 565.

<sup>17</sup> In contrast to the physiology of lactation, the cultural history of menstruation attracted much historical attention. Cf. Shail A. – Howie G. (eds.) *Menstruation. A Cultural History* (Hampshire: 2005); Stolberg M., “Deutungen und Erfahrungen der Menstruation in der Frühen Neuzeit”, in Mahlmann-Bauer B. (ed.), *Scientiae et artes. Die Vermittlung alten und neuen Wissens in Literatur, Kunst und Musik* (Wiesbaden: 2004), vol. 2, 913–931; Stolberg M., “The Monthly Malady: A History of Pre-Menstrual Suffering”, *Medical History* 44 (2000) 301–322; Lord A., “The Great Arcana of the Deity: Menstruation and Menstrual Disorders in Eighteenth-Century British Medical Thought”, *Bulletin of the History of Medicine* 73, 1 (1999) 38–63; Crawford P., “Attitudes to Menstruation in Seventeenth-Century England”, *Past & Present* 91 (1981) 47–73. On menstruation and lactation in folk medicine Cf. Fissell M.E., *Vernacular Bodies. The Politics of Reproduction in Early Modern England* (New York: 2004); Gélis J., *History of Childbirth. Fertility, Pregnancy and Birth in Early Modern Europe* (Cambridge: 1991).

and doctors argued that the production of milk would start before delivery. After birth, the diminishing flow of *lochia* and the increasing production of milk that became thicker and more nutritive were interrelated as well. Hence, until about 1650, medical discourses upheld the uncontested view that the flow of blood and milk were but two products of what was in fact one female flow for generative purposes, the 'Feminine Flux', as Jean Riolan the Younger (1577–1657) called it.<sup>18</sup> Although the substances of blood and milk were by no means the same – neither in appearance, in composition, nor in function – for generative purposes they obviously were not clearly separated. Blood was whitened on its way to the breasts, '[...] and therefore the Infant being born, the Blood is carried no longer to the womb but to the Dugs, and is turned into milk'.<sup>19</sup>

Menstruation and lactation were linked to one another; thus, the blood-milk analogy expressed the cyclic behavior and interdependence of the two fluids. The analogy seemed to be substantiated not so much by the materiality of the two fluids as by the substitution and replacement of blood through milk. Observations about *flows* instead of *fluids* lent weight to these arguments and gave rise to many related assumptions and instructions, e.g. the interpretation of the body as a vascular network.<sup>20</sup> As such, the analogy was far more than a scientific ideal; it was part of the logic of everyday life. Daily experience confirmed that both fluids acted in a manner that was complementary to one other, and the syllogism (milk is a whitened blood) helped to smooth out the uncertainties of the body. In this spirit, the colours red and white were widely used symbols for fertility, and many rules, images and narratives in housekeeping, folk

---

<sup>18</sup> Riolan Jean, *A sure Guide, or, the Best and Nearest Way to Physick and Chyrurgery that is to say, the Arts of Healing by Medicine and manual Operation. Being an Anatomical Description of the Whole Body of Man and its Parts. With their Respective Diseases demonstrated from the Fabrick and Vse of the Said Parts. In Six Books [...]*, written in Latin by Johannes Riolanus [...]; Englished by Nich. Culpeper (London, Peter Cole: 1657) 86.

<sup>19</sup> Bartholin Thomas, *Bartholinus Anatomy. Made from the Precepts of his Father, and from the Observations of all Modern Anatomists. Together with his own*, published by Nich. Culpeper and Abdiah Cole (London, Peter Cole: 1663) 87 (Orig. written in Latin 1641).

<sup>20</sup> Many anatomical discoveries of the seventeenth century were interpreted within a framework of circulating fluids or vascular secretions and described as vessels, tubes, ducts, or containers. Cf. Orland B., "The Fluid Mechanics of Nutrition: Herman Boerhaave's Synthesis of Seventeenth-Century Circulation Physiology", in Orland B. – Spary E. (eds.), "Assimilating Knowledge: Food and Nutrition in Early Modern Physiologies", Special Issue of *Studies in History and Philosophy of Biological and Biomedical Sciences* (Cambridge), 44 (2012); (Epub 2011, Dec. 2). On the doctrine of vascular secretion Ruestow, E.G., "The Rise of the Doctrine of Vascular Secretion in the Netherlands" in *Journal of the History of Medicine and Allied Sciences* 35 (1980) 265–287.

medicine, religion, art, and literature reflected the ambiguous relationship between both fluids.<sup>21</sup>

Beyond what could be observed in everyday life, medical textbooks, midwives' manuals and doctoral dissertations of the Early Modern period relied heavily on ancient authors. Ancient beliefs about menstruation and lactation were not merely illustrations but were employed as proven knowledge confirming the truth of the theory. The author most often quoted was Aristotle; he, in fact, was among the first to describe mother's milk as a further concoction of menstrual blood. Disagreeing with Empedocles' assumption that blood was turned into a white liquid very similar to pus by a process of putrefaction, Aristotle had argued in the *Generation of Animals*:

In the natural course of events, no menstrual evacuations take place during the suckling period, nor do women conceive then; and if they do conceive, the milk dries up, because the nature of the milk is the same as that of the menstrual fluid, and Nature cannot produce a plentiful enough supply to provide both; so that if the secretion takes place in one direction it must fail in the other, unless some violence is done contrary to what is normal.<sup>22</sup>

The theory of lactation in the Hippocratic corpus was less evident, as will be described below. But the author of the Hippocratic treatise *On the Nature of the Child*, who had imagined some kind of communication between breasts and uterus, held a view very similar to Aristotle's theory. The text stated that women who have excessive menstrual flows can expect a great deal of milk once the flow has stopped, while, conversely, women whose menses are slight in quantity will provide their infants with insufficient nutriment.<sup>23</sup> In any case, the ancient medical and philosophical knowledge also gave

<sup>21</sup> Examples can be found in: Zorach R., *Blood, Milk, Ink, Gold. Abundance and Excess in the French Renaissance* (Chicago-London: 2005); Verdier Y., *Façon de dire, façon de faire. La laveuse, la couturière, la cuisinière* (Paris: 1979); Schreiner K., *Maria. Leben, Legenden, Symbole* (Munich: 2003); Fissell, *Vernacular Bodies*; Gélis, *History of Childhood*; Bloody or red milk feature among the main causes of disease cited in livestock-related cases of witchcraft. Cf. Hickey S., "Fatal Feeds? Plants, Livestock Losses and Witchcraft Accusations in Tudor and Stuart Britain" in *Folklore* 101, 2 (1990) 136.

<sup>22</sup> Aristoteles, *De generatione animalium* 4.8, 777a15. The difference is marginal, argues Longrigg, because both philosophers believed that blood was the agent of nutrition and that milk was a surplus residue of blood. Longrigg J., *Greek Rational Medicine. Philosophy and Medicine from Alcmaeon to the Alexandrians* (London-New York: 2003) 74.

<sup>23</sup> Cf. Lonie I.M., *The Hippocratic Treatises "On Generation" "On the Nature of the Child" "Diseases IV"* (Berlin-New York: 1981) 19, 52. As one of the early modern texts discussing the Hippocratic views, see Anonymous, *The Art of Nursing. Or, the Method of Bringing up Young Children according to the Rules of Physick, for the Preservation of Health, and Prolonging Life* (London, John Brotherton: 1733<sup>2</sup>) 16–30.

evidence for the simple supposition that the different liquids that flow through a body are more or less balanced in quantity. Because menstrual blood was said to be necessary for conception, lactation held back the chances of becoming pregnant, and this notion found its material expression in the fact that the menstrual blood failed to appear.

The prolongation of the period of lactation thus could be considered as an adequate auxiliary in balancing pregnancies. As a method widely used in seventeenth century, the contraceptive effect of breast-feeding was one of the reasons why husbands forbade their wives to breast-feed if a son had not yet been born.<sup>24</sup> Another argument was that a woman with an infant at her breast will miscarry, because nature did not intend lactation and conception to occur at the same time. Logically, pregnancy could have adverse effects on the nursling too. The woman's milk would become inferior in quality and diminished in quantity, or, as Luther put it in the sixteenth century, 'the child at the breast would have only skim milk since the one in the womb had taken the cream'.<sup>25</sup>

The doctrine of the interrelation between bleeding and lactating became relevant to practice with respect to its pathological manifestations; many anomalies and illnesses were viewed as defects in the economy of fluids.<sup>26</sup> First, a woman's milk, like her menstrual blood, could take irregular paths (*aberratio lactis*) – from the breasts to the stomach, to the mouth, or to the bladder and be excreted there as a whitish liquor. Doctors identified many periodic discharges of fluid, from either a male or a female person, as menstruation (e.g. haemorrhoids) or, vice versa, as milk secretion.<sup>27</sup> Textbooks documented cases and stories by hearsay, telling of milk moving inside to other locations, expelled during bleeding or instead of urine, tears, or sweat

<sup>24</sup> Cf. Crawford P.M., *Blood, Bodies and Families in Early Modern England* (Harlow: 2004) 61.

<sup>25</sup> Crawford, *Blood, Bodies* 147; Anonymous, *The Art of Nursing* 17.

<sup>26</sup> The description of cases that could illustrate the concept can be found in seventeenth and eighteenth-century treatises as well. Cf. Chamberlen Peter, *Dr. Chamberlain's Midwife's Practice. Or, a Guide for Women in that high Concern of Conception, Breeding, and Nursing Children. In a plain Method, containing the Anatomy of the Parts of Generation. Forming the Child in the Womb. What hinders and causes Conception. Of Miscarriages and Directions in Labour, Lying-inne, and Nursing Children* (London, J. Clowes: 1665) 63–64; Rowley W., *A Practical Treatise on Diseases of the Breasts of Women* (London, F. Newberry: 1772) 21–23; Duden, *The Woman beneath the Skin* 108–109.

<sup>27</sup> If a man was plethoric (naturally disposed towards an excess of humours), then nose-bleeding, haemorrhages, or lactating could be beneficial to him. Numerous stories of menstruating or lactating men circulated through the medical world. Pomata G., "Menstruating Men. Similarity and Difference of the Sexes in Early Modern Medicine" in Finucci V. – Brownlee K. (eds.), *Generation and Degeneration. Tropes of Reproduction in Literature and History from Antiquity through Early Modern Europe* (Durham-London: 2001) 109–152.



and as a vaginal juice, called *flux alba*. Until well into the eighteenth century, stories of migratory menstruation, the flow moving periodically from the ordinary passages to the breasts, were similarly reported.<sup>28</sup> A woman in childbed whose milk had stopped might have feared the outbreak of the menses or a bleeding elsewhere. Others were able to lactate although their menstruation had always been deficient. Continued lactation without any sign of returning menstruation, lactation in aged women, or milk-giving women without pregnancy or a new-born baby: bodily experiences of the connection existed in practically all types of manifestations.

Similarly, every suppression, displacement, and return of milk into the blood flow would consequentially lead to plethora, a thickening of the humours and, if it became chronic, to inflammation and fever. Lack of milk (*defectu lactis*) as well as a surplus of milk (*abundantia lactis*) were therefore viewed as an important cause of the corruption of humours, and milk-fever probably was one of the most-discussed illnesses of women in childbed.<sup>29</sup> Therapies likewise were intended to manipulate the whole flow of the humours, even if the cause of the problem lay in corrupted milk. After she succeeded in evacuating the milk through stool and urine, a French woman in child-bed in 1769 reported an improvement of her condition.<sup>30</sup> But therapies such as bloodletting or treatments with emetics or vesicants were also applied to the effusion of milk. Milk cures, for instance, were supposed a reasonable supplement to blood letting; both fluids were occasionally combined in medical remedies.<sup>31</sup>

<sup>28</sup> Even as late as the 1760s, Gerard van Swieten (1700–1772) reported the case of a woman whose menstrual blood was expelled every month through her breasts. Originally reported by Ambroise Paré in 1585, the same story was repeated by Cornelis Stalpart van der Wiel (1620–1702), who, furthermore, knew of a woman aged forty whose blood burst out of her nipples when she raged in a violent fit of anger. Swieten Gerard van, *Commentaries upon Boerhaave's Aphorisms Concerning the Knowledge and Cure of Diseases* (Edinburgh, Charles Elliot: 1776), vol. VIII, 250.

<sup>29</sup> Cf. Staehelin Johann Jacob, *De lactis defectu positiones [...] pro summis in arte medica honoribus ac privilegiis doctoralibus, rite solenniterque consequendis, publico examini submitti [...]* (Basel, Iacob Bertschi: 1669); Küeffer Wilhelmus Christianus, *Galaktologian seu dissertationem de lacte* (Strasbourg, [s.n.]: 1672); Lehmannus Christianus Godofredus, *Dissertatio inauguralis medica de defectu lactis [...] sub praesidio Georgii Wolffgangi Wedelii [...] pro licentia summis in arte medica honores, insignia et privilegia Doctoralia, more maiorum, rite impetrandi* (Jena, Christophorus Krebs: 1699); Heymans Isaacus, *Dissertatio medica inauguralis de aberratione lactis, et morbis ex ea provenientibus, quam annuente summo numine, ex auctoritate rectoris magnifici Bavii Voorda* (Leiden, Theodorus Haak: 1781).

<sup>30</sup> Pilloud S. – Louis-Courvoisier M., “The Intimate Experience of the Body in the Eighteenth Century. Between Interiority and Exteriority”, in *Medical History* 47 (2003) 470.

<sup>31</sup> The best type of milk to drink was a woman's milk, especially if sucked directly from the breasts. Cf. Orland, “The Fluid Mechanics of Nutrition”.



*Sympathetic organs*

Purported signs of the complex interdependence of the two fluids seemed to offer direct evidence of the sympathy between women's generative organs. Until around 1650, the standard argument was that the blood vessels in the womb, which gradually become enlarged during pregnancy, are connected with those passing through the chest, so that after delivery nourishing substances can be transferred to the breasts to be utilised in milk secretion. In Andreas Vesalius's *Fabric of the Human Body* one finds a detailed description of this process:

These vessels that travel upwards are the ones that take origin from the larger trunks of the great artery and the hollow vein as these are about to proceed through the groins into the leg [...] Though they do not come forth from the same root as the veins that go to the uterus they lie so close to the uterus and are such near neighbors of it that it is believed that the blood that gathers here in the veins of the uterus is able to be taken up by the vessels and carried upwards or that they can receive in their orifices blood from the vessels that descend under the breast bone and can transmit it to the veins and arteries of the uterus.<sup>32</sup>

No part of the body was considered to be as much in concert with the womb as the breasts. In his dissertation *De mammis et lacte* from 1727, Georg Friedrich Gutermann (1705–1784), physician in Kaufbeuren and the father of Sophie La Roche, summarised four reasons for this correspondence that were discussed in the older medical literature. The first reason cited was the topographical anatomy and the immediate proximity of the two organs; the second pointed to the connection between the *venae mammae* and the *vena epigastriacae* anastomosing with each other (a view that so far had not been proved by autopsy).<sup>33</sup> Other physicians, thirdly, held that the nerves were the connection between both organs. But it was only the fourth argument that the author supported to some extent: both organs serve as nature's instrument for feeding the infant.

---

<sup>32</sup> Vesalius Andreas, *On the Fabric of the Human Body. A Translation of De Humani Corporis Fabrica libri septem, Book V. The Organs of Nutrition and Generation*, tr. William Frank Richardson in coll. with John Burd Carman (Novato CA: 2007) 205–207 (Orig. written in Latin 1543). See also Riolan Jean, *Les oeuvres anatomiques de Me. Iean Riolan, conseiller, medecin, et professeur du roy en anatomie et en pharmacie, reveuës et augmentees d'une cinquiemesme partie en cette édition* (Paris, Denis Moreay: 1629), vol. III, 484–485.

<sup>33</sup> For a long period anatomists who agreed with Galen had claimed that a hole exists in the sternum, the breastbone located in the center of the thorax, that served as a pathway for the veins. Cf. Stolberg M., "A Woman down to her Bones: The Anatomy of Sexual Difference in the Sixteenth and Early Seventeenth Centuries", *Isis* 94 (2003) 274–299.

Because the child is accustomed to being nourished by its mother's blood, he argued, it is unable to suddenly switch from that liquid to more solid nourishment; milk is thus intermediate between blood and solid food.<sup>34</sup>

Ideas about communication shaped concepts of the structure and function of the organs involved. For example, the breasts were described as organs involved in nourishment and reproduction. As Helkiah Crooke (1576–1648) explained in his well-known *Mikrokosmographia* of 1615, during pregnancy, 'they swell proportionably as much as the womb [...] and moreover the infant is lodged on that side (of the womb) where the brest growes greater'. Composed of spongy, smooth, moist flesh, and filled with veins, arteries, nerves and glands, the breasts were the 'Magazine' or 'Storehouse of Meat', he stated, 'wherefore their substance like that of a sponge is very rare or porous, that they might bee able to receive the greater quantity of liquor'.<sup>35</sup>

Accordingly, the womb's food likes and dislikes corresponded with the stomach's work as well as the breast's task. Great care should be taken in choosing food for pregnant women. Because pregnant and breast-feeding women have good appetites, one should provide whatever they ask for to eat but never too much. 'For when the Nurse is high fed, the Womb swelling with Liquor assumes a Furiousness, and gives no small Taint to the milky Liquor in the Breasts', argued Italian physician Bernardino Ramazzini (1633–1714).<sup>36</sup> Pregnant women therefore had to be more

<sup>34</sup> Gutermann Georg F., *Dissertatio inauguralis medica de mammis et lacte, in qua status tam naturalis, quam praeternaturalis, hujusque therapia rationalis* (Tübingen, Joseph Sigmund: 1727) 12–14.

<sup>35</sup> Crooke Helkiah, *Mikrokosmographia. A Description of the Body of Man, together with the Controversies and Figures thereto Belonging / Collected and Translated out of all the best Authors of Anatomy, especially out of Gasper Bauhinus and Andreas Laurentius* (London, W. Iaggard: 1615) 157–158. The glands, too, were described as small acorns able to absorb and secrete the humours.

<sup>36</sup> Ramazzini Bernardino, *Health Preserved. In two Treatises, I. On the Diseases of Artificers [...]* (London, John Whiston, and John Woodyer: 1750) 142; Muralt Johannes, *Kinder-Büchlein Oder Wolgegründeter Unterricht / Wie sich die Wehe-Muttern / und Wartherinnen gegen schwangern Weibern in der Gebuhrt; gegen denen Jungen Kindern und Säuglingen aber noch der Gebuhrt zuverhalten haben* Muralt (Zurich, Gessner: 1689) 157–160. Many physicians argued that diseases in nursing women resulted from the suppression of the menses. Bleeding should resemble the menstrual purgation. After bleeding, the nurse should drink whey, the milk product that was generally said to be the best medication for blood purification. Wittich Johannes, *Vade Mecum. Das ist. Ein Künstlich New Artzneybuch, so man stets bey sich haben und führen kan, In fürfallender Noth sich Hülfß daraus zuerholen, wieder allerhand Kranckheit deß Menschlichen Leibes, vom Hüpt an biß auff die Fußsolen [...]* In gewisse Capitel und richtige Ordnung gebracht [...] Auch zum Anfang ein unterricht gesetzt, wie man durchs gantze Jahr gute Gesundheit erhalten möge. Sampt eines vornemen erfahrenen Mönchs Experimentlein (Leipzig, Bartholomaeus Voigt: 1600) 2–3.

careful than others when it came to the so-called non-naturals (meat and drink, sleep and watching, exercises and rest), for a wrong diet could corrupt the blood as well as the milk and harm the unborn as well as the born.<sup>37</sup>

Several other precarious situations could result from the communion of womb, stomach, and breasts. If a nurse swallowed a hair with her meal, it could pass to her breasts, causing the disease '*Trichiasis*' or 'Hair in the Nipple', as the famous Danish professor of anatomy Thomas Bartholin (1616–1680) reported.<sup>38</sup> Midwife Jane Sharp (1641–1671) noted that women are in danger of going mad when blood comes forth at their nipples. Careful observation of the nipples should be a midwife's task: 'By the colour of the nipples the state of the womb is perceived; if the Paps look pale or yellow that should look red, the womb is not well'.<sup>39</sup> The condition of the breasts further indicated the date of birth, the sex of the unborn child, and its state of health: 'If the right breast swell and strut out the Boy is well, if it flag it is a sign of miscarriage, judge the same of the Girle by the left breast, when it is sunk, or round and hard, the first signifies abortion to be near'.<sup>40</sup> Highly controversial among physicians was the question of sexual intercourse. Should nursing women abstain from embracing their husbands? If sexual intercourse puts an end to menstruation, then intense bodily excitement might reduce all milk secretion, '[...] for Copulation raises a certain Motion in the Womb, upon which depends the Breeding of the Milk'.<sup>41</sup> To sum up, the sympathy between the organs and the analogy between flows and fluids complemented each other. Far from being beneficial, this system of organic relations most often was treated as the cause of diseases.

---

<sup>37</sup> The Hippocratic theory of abortion was cited as evidence. A failure in food supply as well as a mother's continued menstruation during pregnancy could result in abortion. In both cases the foetus could die of starvation. Cf. Lonie, *The Hippocratic Treatises* 245. On the Galenic theory of the relationship between the maternal nourishment and foetal complexion, Cf. Prosperi L., "Les fraises d'Eve. Le désir alimentaire féminin d'après le discours médical français au début de l'époque moderne" in Duhart Frédéric (ed.), *Anthropologie historique du corps* (Paris: 2006) 253–267; Fildes V.A., *Wet Nursing. A History from Antiquity to the Present* (Oxford: 1988) 9–11.

<sup>38</sup> Bartholin, *Bartholinus Anatomy* 87.

<sup>39</sup> Sharp Jane, *The Midwives Book, or the Whole Art of Midwifry discovered*, ed. by Hobby E. (Oxford: 1999) 102 (Orig. written in 1671).

<sup>40</sup> Sharp, *Midwives Book* 103.

<sup>41</sup> Ramazzini, *Health preserved* 144.

*Embryonic nutrition*

Yet the unique physiological features of women, and especially the relation between menstruation and lactation, were not central only to an understanding of women's state of health. Next to be considered was the role the two phenomena played with respect to the formation of the offspring. The belief that conception and menstruation were related had an impact on ideas about embryogenesis. Blood was generally considered to be the ultimate nutritive substance. It flowed throughout the body, bringing fresh material and the heat of the heart even to the smallest and most peripheral parts of the body. Concerning the formation of the foetus, however, it seemed obvious that the nutritive and generative functions of blood were intermingled. No other sphere of physiology could illustrate as vividly what Aristotle had described as the proper functioning of the vegetative soul: generation, growth, and nutrition of plants and animals (including human beings) are governed and preserved by one and the same soul, which is the most elementary principle of life.<sup>42</sup>

Until the middle of the seventeenth century most medical writers argued that maternal blood provides the raw material for nourishing the unborn child (after the *vis plastica* of the semen and the innate heat of the womb had caused foetal development).<sup>43</sup> The argument was originally developed by Aristotle, who described the *catamenia* as the female contribution to generation. Semen affected the menstrual blood in a specific way:

The action of the semen of the male in 'setting' the female's secretion in the uterus is similar to that of rennet upon milk. Rennet is milk which contains vital heat, as semen does, and this integrates the homogeneous substance and makes it 'set'. As the nature of milk and the menstrual fluid is one and the same, the action of the semen upon the substance of the menstrual fluid is the same as that of rennet upon milk. Thus when the 'setting' is effected, i.e., when the bulky portion 'sets', the fluid portion comes off; and as the earthy portion solidifies membranes form all round its outer surface.<sup>44</sup>

The subtlety of the Aristotelian theory of generation and the many controversies about the impure state of menstrual blood prompted physiologists to seek an understanding of this idea in all its details. According to Helkiah

---

<sup>42</sup> On the crucial role of the 'vegetative soul' in Galenic physiology, see Roger, *The Life Sciences* 56–57.

<sup>43</sup> Cf. Roger, *The Life Sciences* 41–44.

<sup>44</sup> Arist. *GA* 2.4, 739b20.

Crooke, many questions had to be answered: Which parts of the embryo are produced by the seed and which by the menstrual blood? Can blood, which is generally impure and poisonous, be a nourishing material?<sup>45</sup> If women's heat is naturally weak, as most scholars would have agreed on the basis of Aristotelian biology, how can a woman transform her blood into embryonic organs?<sup>46</sup> Conceptualising the role of menstrual blood as that of essential embryonic food led to many ideas, among which the evaluation of different parts of the disposable blood seemed to be most persuasive.<sup>47</sup>

Another theory, which Crooke considered to be quite obscure, was traced back to the Hippocratic acknowledgment of two prenatal foods, blood and milk.<sup>48</sup> According to Hippocrates, he argued, the foetus was nourished during the first months of life with nothing but pure blood. But when the unborn child grows and begins to move in the womb, some

<sup>45</sup> If menstrual blood kills herbs, makes trees barren, or dogs mad, then it is impossible to imagine a healthy food derived from it, noted Jean Fernel. Not until the foetus has developed its own liver to clean and prepare pure blood from its mother's raw material, he goes on, can maternal blood be appropriate for the foetus. Forrester, "The Physiologia" 589. Hieronymus Fabricius ab Aquapendente, who also believed in the impurity of menstrual blood, came to the conclusion that monthly blood is bad because 'it is packed in and does not readily exude', but the blood in the pregnant uterus 'moves and flows continually and readily oozes out. The result is that the blood is not bad'. Fabricius ab Aquapendente Hieronymus, *The Embryological Treatises of Hieronymus Fabricius of Aquapendente* (Ithaca NY: 1942) 291. Another solution of the problem was to argue that only the purest part of the mother's blood is used. Crooke noted that a pregnant woman often has a 'greenish pallid' complexion because she lacks her purest blood, which was needed for her infant. Crooke, *Mikrokosmographia* 317.

<sup>46</sup> Aristotle had argued that women have less "vital heat" and therefore will be smaller and weaker than man. Because of her colder metabolism, a woman consumes food less quickly, thus leaving residues of blood which is necessary for the nutriment of the offspring. On Aristotle and women, among many others I found helpful: Föllinger S., *Differenz und Gleichheit. Das Geschlechterverhältnis in der Sicht griechischer Philosophen des 4. bis 1. Jahrhunderts v. Chr.* (Stuttgart: 1996).

<sup>47</sup> Jacob Rueff differentiated between three parts of the menstrual blood, one which the foetus extricates, a second part needed for the replenishment of the placenta; only the third and impurest part would remain in the womb and be discharged post partum. Rueff Jacob, *De conceptu et generatione hominis, lib. primus* (Frankfurt, Petrus Fabricius: 1580) 9. A summary of the debates around 1600 is given by Riolan Jean, *Les oeuvres anatomiques* 935–943.

<sup>48</sup> Crooke, *Mikrokosmographia* 317; see also Rueff, *De conceptu* 10; C[hamberlayne] T[homas] et alii, *The Compleat Midwives Practice, in the most weighty and high Concernments of the Birth of Man. Containing perfect Rules for Midwives and Nurses, as also for Women in their Conception, Bearing, and Nursing of Children. From the Experience not onely of our English, but also the most accomplit and absolute Practicers among the French, Spanish, Italian, and other Nations [...]* (London, Nath. Brooke: 1656) 69. Mary Fissell identified the authors as a group of four London doctors. See Fissell, *Vernacular Bodies* 63.

blood will be directed to the breasts and converted into milk. Part of this remains in the breasts, another part comes back to the womb, as if the blood was circulating (which, in 1615, was unimaginable). Hippocrates was obviously wrong, Crooke consequentially concluded, because there is neither a need to feed the embryo with milk nor an instrument with which to do so.<sup>49</sup>

In contrast to blood, milk as a foodstuff would require embryonic digestion. Yet one of the most authoritative embryologists of the sixteenth century, Hieronymus Fabricius ab Aquapendente (1537–1619), had stated that the subordinate functions of the digestive organs did not yet function before birth. Using the analogy between uterus and liver, he had argued:

For just as the liver continually furnishes and supplies blood to the animal through the veins, and the heart pours out heat through the arteries to strengthen and perfect all natural processes, so, too, the uterus of a pregnant woman, as if it were the liver and heart, supplies and transports all these elements into the entire fetus through the veins and arteries.<sup>50</sup>

For him, there were several possible ways for the child to be nourished. First, it could suck the mother's blood directly out of the veins of the womb. Second, the mother's blood could be sent through the larger vessel of the umbilical cord to the placenta (foetal liver); from there, the arteries could distribute the fresh blood throughout the child's entire body or send it back to be stored. Milk, however, was not among the possible nourishments he discussed.

But why, then, does the maternal body begin producing milk during pregnancy? Even more important was the question of why men, virgins and post-menopausal women sometimes have milk in their breasts. Is there any evidence to support the assumption that milk can be generated before, or even without, conception? Does this mean that milk is not produced in the breasts from the uterine material sent to them, but instead is derived from a substance other than menstrual blood? Why do

---

<sup>49</sup> The original text of Hippocrates' description of the mammary glands holds: 'Women produce milk, men do not. Women's nature is fine with regard also to the glands, like the rest of the body; and they change the food which they draw into themselves into milk. It goes from the womb to the breasts for the child after birth as nourishment, which the omentum squeezes out to parts above it, if it has an excess, cramped by the foetus'. Craik E.M. (ed./tr.), *The Hippocratic Treatise On Glands* (Leiden-Boston: 2009) 81.

<sup>50</sup> Fabricius, *The Embryological Treatises* 281.

women menstruate at all, and why does the monthly bleeding stop during pregnancy?<sup>51</sup>

Early modern definitions of the menses are far from clear. A variety of bloody emissions could have been interpreted as menstrual blood, and different terms described the physiological phenomenon of bleeding, among them 'monthlies', 'ordinaries', 'flowers', or 'menses'. 'The plethora of terms available to describe menstrual blood', argued Cathy McClive, 'suggests that perceptions of the type of flow were heavily dependant on the circumstances and condition of the body when it flowed'.<sup>52</sup> In spite of all the inconsistencies that envelop the history of menstruation, one can, according to Michael Stolberg, roughly distinguish between three different models of early modern perceptions of menstruation: the cathartic, the plethoric and the iatrochemical model. Until the late sixteenth century the cathartic theory of menstruation dominated discussions. Menstruation served primarily as a means of freeing women from the poisonous, moribific, impure matter that constantly accumulated in the female body.<sup>53</sup> By about 1600, this set of explanations had been largely replaced by the new 'plethora model'. In a healthy woman, medical writers now declared, menstrual blood usually would not be poisonous or unhealthy. Non-pregnant and non-lactating women had to get rid of this blood at regular intervals because of its sheer volume. Although this explanation was substantiated by evidence from everyday experience, it raised another question: why then did plethora frequently occur in men, too? At this point iatrochemical ideas entered the debate, Stolberg argues; a surplus of blood was not only found in female bodies. Instead iatrochemists relied on the notion of a specific menstrual 'ferment' that drove the blood or humours into intense commotion every month, stretching and expanding the vessels involved to their utmost limits.<sup>54</sup> While in the plethora model, the vessels gave way at the point of least resistance, fermentation asserted that the impure material was sufficient to cause fermentation or effervescence.

<sup>51</sup> Crooke, *Mikrokosmographia* 193–196; see in the same manner Bartholin *Bartholinus Anatomy* 87.

<sup>52</sup> McClive C., "Menstrual Knowledge and Medical Practice in Early Modern France, c. 1555–1761" in Shail – Howie, *Menstruation* 77.

<sup>53</sup> 'Due to her colder and more humid constitution, woman constantly accumulated crude, peccant, excremental matter in her body. In the case of conception, it served as the substrate for the powerful semen, but when no conception occurred, the 'expulsive faculty' of the uterus got rid of it via menstruation'; Stolberg, "The Monthly Malady" 304.

<sup>54</sup> Stolberg M., "Menstruation and Sexual Difference in Early Modern Medicine" in Shail – Howie, *Menstruation* 94.



These three explanations, however, do not answer the questions raised by Helkiah Crooke. Crooke, a well-known member of the Royal College in London, had absolutely no doubt that the menses provided the primary material of milk production. With reference to the female anatomy, he also considered it to be in principle conceivable that virgins and other non-pregnant women could generate milk. Because of the great abundance of blood in female bodies and because women have veins in the chest after the age of fourteen – veins that ‘water the dugs’ – and glands that can boil and alter the blood, disorders can develop. However, cases of lactating men could not be explained in this way.

Male lactation, Crooke went on, could only be explained if Hippocrates was right about ‘a double generation of Milke [...] and a double nature thereof’. Crooke referred to the Hippocratic treatise *On Glands*, in which lactation is explained by the swollen womb that presses against the stomach because of the growing child. If this pressure occurs while the stomach is filled with the fatty parts of food and drink then this material will be squeezed out into the omentum and the flesh.<sup>55</sup> In other words, according to the Hippocratic theory two kinds of milk existed, but only one of them can be found in the male body. If the ‘breeding of the humoral material’ (including a final *concoction* in the breasts) is completed, the milk is ‘perfectly white, sweete, and moderately thicke, and fitte to suckle an Infant’; the other milk, which could also be found in men’s bodies ‘is white indeed because it beareth the colour and forme of the part from whence it floweth, but it hath neither the true nature of a nourishing *Chymus* or *humour*, nor the sweetnes nor the power or vigour of nourishment, and therefore it deserveth the name of Milke, not by his quality or specificall forme, but onely for his colour, for it is thinne and waterish, altogether unprofitable to nourish an Infant’.<sup>56</sup> While the former originated from uterine blood that was brought from the womb to the mammary glands, by ‘expression and refluence’ and ‘attraction’, the latter is a milky fluid or *chyle* produced during the process of digestion in the stomach, which only occasionally will be directed to the breasts. A ‘true’ and ‘perfectly concocted’ milk, Crooke concluded, will not be generated before conception,

---

<sup>55</sup> Crooke, *Mikrokosmographia* 194. The Hippocratic writers compared the process with the use of large quantities of oil for smearing a hide; the pressure of the womb functions like squeezing the absorbed oil. The fatty substance in a woman’s chest, warmed, sweetened and whitened, is squeezed into the breasts. In case of a pregnancy this would happen as soon as the embryo had started to move. Cf. Lonie, *The Hippocratic Treatises* 13.

<sup>56</sup> Crooke, *Mikrokosmographia* 149.

but sometimes from the breasts a thin and raw milk could flow, made of the residues of the proper nourishment of the breasts.

Crooke knew very well that his view could be contested, and he himself introduced into the discussion one of the main objections. Why does nature allow two kinds of milk to be produced, and why is the infant not nourished by the same food both during and after pregnancy? Crooke dismissed both objections rather easily by referring to the common theory of digestion. Chyle, or the raw milk, was the product of digestion. If the unborn child were to be fed with chyle, he argued, it would require a functioning digestive apparatus that would enable its body to prepare and perfect the nourishing substances. After birth, in contrast, infants would be unable to thrive on blood, a possibility which some authors found inhumane and beastly anyway. Since blood is hotter than milk, it would become an unpleasantly bitter food during the different steps of digestion, a process which he labelled with the term *concoction*. Milk as a cold liquid would instead keep its sweetness during the different stages of this process.<sup>57</sup>

### *The business of concoction*

Thus, Crooke was only able to clarify the question of why milk was produced prenatally by referring to the physical process of concoction. What, then, is concoction? What convinced him that concoction occurs? The understanding of the prenatal processes of growth creates the need for an excursus on concoction as the literally physical expression of bodily matter transformation. Once again, we have to take a multi-layered concept into consideration. Historians who have engaged with early modern medical theories of digestion and alimentation tend to interpret the term 'concoction' in a clear physiological sense and to describe it as a synonym for the stomach's role in digestion.<sup>58</sup> This is beyond doubt the way in which most authors during the Early Modern period translated it (digestion by heat or *pepsis*). Many also used it as a synonym for the four kinds of digestion (in the stomach, in the liver, in the arteries, and in the peripheral parts of the body).<sup>59</sup>

<sup>57</sup> Crooke, *Mikrokosmographia* 196.

<sup>58</sup> See e.g. Schoenfeldt, *Bodies and Selves* 8–29.

<sup>59</sup> A detailed description of concoction as digestion and nutrition can be found in Albala K., *Eating Right in the Renaissance* (Berkeley-Los Angeles: 2002) 54–62.

But for Crooke and his generation, concoction could also take the meaning of a vital force performing different physical actions. It was the visible part of the vegetative soul's power to transform one body into another and, in doing so, to take the step from crudity to perfection. This power or faculty did not assume a definite shape, but usually occurred in varying forms, including attraction, retention, maturation, gestation, ripening and expulsion.<sup>60</sup> This much wider definition of the term *concoction* originally comes from Aristotelian physics. For Aristotle the paradigmatic instances of concoction in the living body were the transformation of food first into blood, and then into all the other homoeomerous parts of the animal; similarly, 'surplus' blood undergoes further concoction, which turns it into milk, fat, menstrual fluid, or semen.<sup>61</sup> Thus, Aristotle not only explained digestion of food in a narrower sense but saw every kind of matter transformation in living beings in terms of concoction. Organ-formation, foetus-differentiation or the complex manifestations of spontaneous generation; all counted as 'concoction'.<sup>62</sup>

In consequence, the innate heat of the living being was not the only agent that initiated alterations of matter, when something new came out of what already existed. Such processes could also be promoted by extraneous heat (e.g. taking a bath, the sun). The existence of any kind of natural heat was decisive:

Concoction is a process in which the natural and proper heat of an object perfects the corresponding qualities, which are the proper matter of any given object [...] concoction ensues whenever the matter, the moisture, is mastered, for the matter is what is determined by the natural heat in the object.<sup>63</sup>

In 1616, before he became famous, William Harvey (1578–1657) noted the confusion among authors trying to explain concoction in more detail. In his anatomical notebook he wrote:

---

<sup>60</sup> Crooke mentioned that 'the Physitians of old time have beene a great difference among themselves, whether the Guttes have onely an expulsive faculty, or all those foure which serve as Hand mayedes to Nourishment, the Drawing, Reteinyng, Assimilating, and Expelling'. Crooke, *Mikrokosmographia* 161.

<sup>61</sup> See for the whole paragraph Freudenthal G., *Aristotle's Theory of Material Substance. Heat and Pneuma, Form and Soul* (Oxford: 1995) 22–30; Lloyd G.E.R., *Aristotelian Explorations* (Cambridge: 1996), ch. 4, The master cook.

<sup>62</sup> Cf. Lloyd, *Aristotelian Explorations* 100.

<sup>63</sup> Aristoteles, *Meteorologica* 4.2, 379b12–34.

Some consider it liquefaction; some grinding and cutting and special attraction by individual parts, others a kind of putrefaction and fermentation; others a distillation through descent and retort. All have spoken partly correctly, partly incorrectly, because it is not something wholly of itself alone. Therefore philosophically (for this is a philosophical dispute). Coction is change of the whole substance with generation and corruption. Chyle and blood from food and drink mixed. Chyle is first.<sup>64</sup>

Although concoction was still a poorly understood process, he went on, one could indeed compare it to a distillation in 'a hypothetical retort in which it is liquefied by the heat of the liver'. Concoction – or, in the concrete case, digestion – can be compared with what the alchemist does in his laboratory. The food is broken down in the same way as all composed material is broken down, and one should not compare this process with the process of putrefaction as some did, because the food 'has acquired a better form'.<sup>65</sup>

Obviously, the problem of early modern physiologists was that Aristotle's explanation itself lacked clarity. On the one hand, and especially with respect to generation, the transformation of matter was frequently accompanied by putrefaction and humidity. What rotted was merely the residue of still usable matter that could become the object of a concoction. With the aid of ripening, boiling, or roasting, the natural heat would perfect this raw material and transform it into something new. But Aristotle's concoction could also mean the opposite, a kind of inconcoction, due to coldness, and resulting in species that are in a raw or unprocessed state.<sup>66</sup> Here the transformation took place only in a deficient manner, either because the fire was inadequate or because there was too much moisture in the material to be roasted. Inconcoction, in some sense, was the opposite of ripeness or perfection. Failures, immaturity, incomplete degrees of ripeness etc. could always be the result of the whole process of matter transformation; inconcocted materials were merely parboiled or scorched. In any case, a bad concoction could never be corrected later, which explains why many early modern diseases resulted from digestive disorders.

---

<sup>64</sup> Harvey William, *Lectures on the Whole of Anatomy, an Annotated Translation of Prelectiones Anatomiae Universalis*, tr/an. O'Malley C.D. (Berkeley-Los Angeles: 1961) 83–84.

<sup>65</sup> Harvey, *Lectures* 85.

<sup>66</sup> Anatomist Thomas Bartholin discusses with reference to Aristotle whether the body fat is a blood excrement congealed by cold. Bartholin, *Bartholinus Anatomy* 4.

Every description of nutrition, consequentially, reflected a multi-staged process taking place in different locations and with a variety of effects.<sup>67</sup> Digestion, as a physiological process of food processing, began with chewing and swallowing of food in the mouth and continued with the transformation to chyle of this chewed, masticated, papescent food (or chymus) in the stomach by way of grinding, acid fermentation and heat in the stomach.<sup>68</sup> The beginning of concoction within the stomach would then be perfected in the guts, the mesenterium, the pancreas, spleen and liver, affiliated with each other by a host of vessels that carry the chyle. The chyle was inserted into the veins that surrounded the stomach and the entire gut, the 'mouths' of which end in the mesentery and the 'coat' that enclosed all of the digestive organs.<sup>69</sup>

The third step was sanguification in the liver, where chyle was turned into blood, which meant that, on the one hand, the thicker cream of the nutritive liquor was saturated with the red moisture of the liver. On the other hand, chyle's whey was separated to yield urine (which then passed to the bladder).<sup>70</sup> The final step was called assimilation (or nutrition) and took place in every part of the body. Concoction, therefore, was not completed with the production of new blood. All parts of the body were involved in transforming substances into a final stage that was needed to maintain life. Blood itself was the raw material that had to be further concocted in order to produce several other substances. Secretions as well as residues, excrements or intermediate substances thus were the result of this process. Chyle, in fact, was produced from the nutritive material in the last stage of digestion before being passed up to the liver, where the process called *sanguification* took place.

---

<sup>67</sup> Cf. Albala, *Eating Right* 54–60.

<sup>68</sup> According to Bartholin the process of fermentation of the ingested food comes first, before concoction by heat. The reason is that hard things must be broken into pieces, which cannot possibly be done by the natural heat of the stomach alone. Bartholin, *Bartholinus Anatomy* 21.

<sup>69</sup> Diseases were caused by destructions in the abdominal vessels, because: '[...] it often happens, that by reason of the intemperancy of men, abundance of humours flowing through so many Vessels, the pores which carry the Chyle are obstructed or [...] stopped, and the Juyce being putrified, it causeth feavers'. Vesling Johan, *The Anatomy of the Body of Man. Wherein is Exactly Described every Part thereof, in the same Manner as it is Commonly Shewed in Publick Anatomies* (London, Peter Cole: 1653) 15 (Orig. written in Latin 1647).

<sup>70</sup> When it came to the heart, the new blood was heated and mixed with air and became the lighter-coloured arterial blood that travelled through the arteries. Details can be found in Wear, *Knowledge and Practice* 171–175.

Coming back to Hooke's interpretation of the Hippocratic analogy between chyle and milk, it now becomes comprehensible that chyle was only considered to be 'milk' insofar as it looked like barley cream or milk. The term chylus (from the Greek *chylos*, Latin *succus*) as such was the synonym for the masticated food turned into a fluid state. Like menstrual blood, chyle had to be 'twice-concocted' within the mammary glands in order to become real milk. However, if milk was made of chyle it must necessarily have been colder than blood, because the nutritive liquor in this case was not brought to the heart but would directly pass from the stomach via the guts and the omentum to the upper part of the body. This however meant a reduction of concoction resulting in a colder substance. With respect to the problem of male lactation, the question now seems to be slightly different: Could it be that the content of the digestive system was directed to the breasts?

### *Chylification and 'White Milk'*

At the beginning of the seventeenth century, a theory of milk production that differed from the one inherited from the ancients was quite unthinkable. Milk was made from blood; only in the case of male lactation and other non-natural states could physiologists accept the Hippocratic idea that the milky fluid found at different places in the lower belly sometimes appears in the breasts. Half a century later, things had changed radically. Most thinkers now felt that the idea that milk was not generated from blood, but from chyle, was at least worthy of consideration. But by the turn of the eighteenth century, it seemed as if the old theory had been abandoned completely. 'Milk is part of the Chyle, which by the Glands of the Breasts is separated into the Lacteal Tubes, for the Nourishment of the Child', was now seen as state-of-the-art knowledge.<sup>71</sup> Milk was supposed to be a derivative of chyle, or in the words of Herman Boerhaave (1668–1738), the most influential teacher of early eighteenth-century medicine, milk

---

<sup>71</sup> Groeneveld Joannes, *The Grounds of Physick. Containing so much of Philosophy, Anatomy, Chimistry, and the mechanical Construction of a humane Body, as is necessary to the Accomplishment of a Physitian. With the Method of Practice in common Distempers. Extracted from the most eminent Authors, both antient and modern* (London, W. Taylor, J. Osborn and J. Pemberton: 1715) 32 (Orig. written in Latin 1714). The opinions of the ancients in this case have to be considered as absurd, the physician and chemist Louis Lémery argued in his treatise on food. Lémery Louis, *Traité des aliments* (Paris, Pierre Witte: 1702) 274.

was that animal part which 'has felt the vital forces of the body, mixed with the blood, passed thro' the arteries and the veins, and been soon separated again. And this can be no other than chyle from vegetables, turned to milk, and separated in the breasts'.<sup>72</sup>

The radical reorientation was the result of a new anatomical knowledge of the 1630s that, among other things, led to a revival of the old debate about the 'uterine milk' as an alternative food for the unborn child.<sup>73</sup> In the middle of the seventeenth century, an increasing number of anatomists and physiologists challenged the function of the amniotic fluid, which from the perspective of the sixteenth-century physiologists had been considered a waste humour, the embryo's sweat and urine, held under the amniotic membrane in order to envelop and carry the foetus (its allantoic coat).<sup>74</sup> Now, the watery fluid was compared to milk whey. As the physician and anatomist Walter Needham (1632–1691) asserted in the first main treatise on the issue in 1667, in the later months of pregnancy the foetus can take the milky fluid into its stomach.<sup>75</sup> Reminding his colleagues that milk had been observed in the infant's breast at birth, he asked where it might have come from, if not from uterine milk. Many embryologists followed his argument, and some held that blood *and* milk should serve as food.<sup>76</sup> Others, like Anton Deusing (1612–1666) or Thomas Wharton (1614–1673), taught that menstrual blood played no role at all in nourishing the foetus. Nor did it change into milk after parturition as the old school of medical knowledge had taught. Milk itself was the foetus's food.<sup>77</sup>

William Harvey was probably the first to develop this argument. In his treatise *De generatione animalium* published in 1651, he stated as an indisputable fact that milk in its purest form is the embryonic food. Harvey was an enthusiastic ovist, who gleaned most of his empirical knowledge on embryology from studying the hen's egg. His eyes fixed on the

---

<sup>72</sup> Boerhaave Herman, *A New Method of Chemistry. Including the Theory and Practice of that Art. Laid down on Mechanical Principles, and accommodated to the Uses of Life* (London, J. Osborn and T. Longman: 1727) 180.

<sup>73</sup> Another effect was an increasing trend to locate bodily functions in the organs, which I cannot treat in detail here.

<sup>74</sup> Cf. Forrester, *The Physiologia* 585; Riolan, *Les oeuvres anatomiques* 941–942.

<sup>75</sup> Needham Walter, *Disquisitio anatomica de formato foetu* (London, Gulielmus Godbid: 1667).

<sup>76</sup> An overview is given in Needham J., *A History of Embryology* (Cambridge: 1959) 158–159.

<sup>77</sup> Cf. Deusing Anton, *Exercitatio physiologico-medica de nutritone animalium. Publico examini subjecta in illustri* (Groningen, Bronchorst: 1660); Wharton Thomas, *Adenographia. Sive glandularum totius corporis descriptio* (Amsterdam, Joannis Ravenstein: 1659) 38–41.



white of this egg, he browsed through the ancient literature for arguments that could prove his main hypothesis: the notion that the albumen is the equivalent of milk. In the *ovi albus liquor* of Pliny, the *ovi candidum* of Celsus and, perhaps most importantly, Aristotle's comparison of the formation of the foetus with the clotting of milk, Harvey found a wealth of evidence in the literature for his hypothesis that the 'cold, sluggish, white fluid of the egg, of different thickness at different places (thinner at the blunt and sharp ends, thicker in other situations)' is the embryo's one and only food.<sup>78</sup> Like the chick in the egg nourished first by egg white, and later, when this is consumed, by the yolk or by milk, the human unborn child, too, should be nourished by nothing but milk. The thinner and purer part of milk, which is imbibed by the umbilical vessels, supplies the 'primo-genital parts'; the rest, like milk, could be sucked by the older foetus with its mouth and concocted in its stomach.<sup>79</sup>

### *The milk veins*

But the question of milk circulating through the body was not only a theme for embryologists. 'We all live by our own milk' should become the basic theorem of physiology, long into the eighteenth century.<sup>80</sup> Independent of age, sex or social status, every body was supposed to be nourished by a whitish fluid quite similar to milk, since the 'passages of the milk transport' lay open to the eyes of the anatomist, as Thomas Willis (1621–1675), one of the influential members of the Oxford club of medical chemists, put it.<sup>81</sup> 'There are no convenient wayes or conduits, by which Blood may be, in a due quantity, imported into the Paps, there to be whitened into Milk', was how another well-known British naturalist, Walter Charleton (1619–1707), summarised the recent findings of anatomy.<sup>82</sup> Not

<sup>78</sup> Harvey William, *The Works of William Harvey* (London: 1847) 211–212.

<sup>79</sup> More on Harvey's theory of embryonic nutrition can be found in Needham, *A History of Embryology* 115–116.

<sup>80</sup> Van Swieten, *Commentaries upon Boerhaave's Aphorisms* (1766), vol. XIII, 199.

<sup>81</sup> Willis Thomas, *Dr. Willis's Practice of Physick, being all the medical Works of that renowned Physician. Containing these Ten Several Treatises* (London, T. Dring, C. Harper and J. Leigh: 1681) 148. But then the logical consequence of this new view was the question: why do pregnant and women in child-bed suppress the menstrual blood? Willis discussed this question at length, arguing amongst others that the growing belly consumes more nutritious humour.

<sup>82</sup> Charleton Walter, *Natural History of Nutrition, Life, and Voluntary Motion containing all the New Discoveries of Anatomist's and Most Probable Opinions of Physicians, concerning*

blood-vessels but chyloferous vessels transport the nutritive material to the breasts where it will be converted into a milk that can serve as the perfect nourishment of the child.

The passages referred to here were Gaspare Aselli's (1581–1626) so-called milk veins or lacteals (*vena albae et lacteae*), one of the fundamental discoveries of the early 1620s. Later generations of medical historians would retrospectively celebrate this event together with William Harvey's formulation of the theory of blood circulation as the 'wonders of anatomy'.<sup>83</sup> Aselli's *De lactibus sive lacteis vasis quarto vasorum mesaraicorum genere* appeared in 1627, Harvey's *Exercitatio anatomica de motu cordis* in 1628. Both authors, who knew nothing about one another (Aselli, professor of anatomy in Padua, died in 1625, and his work was published posthumously), had already been working on these questions for years. Harvey promulgated his views about the circulatory system over a period of nine years, especially in his anatomical lectures held in Oxford. Aselli first observed the existence of the lacteal vessels when he dissected a dog in 1622 but did not want to publish his discovery immediately. He first sought further proof and in fact found evidence that lacteals existed in a variety of quadrupeds.<sup>84</sup>

Among the multiple consequences of both discoveries, the more unspectacular and little-known effect was a considerable impact on prevailing views of nutrition. One of the assumptions that led William Harvey to his discovery of blood circulation resulted from knowledge about the role of the liver as the 'factory of blood' (*sanguificationis officina*). Like his contemporaries, Harvey had believed (in keeping with Galen's teachings) that all of the juice of the ingesta (chyle) can pass through the veins of the mesentery and from there to the liver. He also knew that fresh blood could only flow in one direction because of the valves in the heart and the large veins. Hence, he calculated that the quantity of blood discharged by

---

the *Oeconomie of Human Nature. Methodically delivered in Exercitationes Physico-anatomical* (London, Henry Herringman: 1659) 20.

<sup>83</sup> Cf. Aselli Gaspare, *De lactibus sive lacteis venis*, ed. with an introduction by P. Franceschini (Milan, Episteme: 1972). On the history of Aselli and the lymphatic system see Rothschild K.E., *Geschichte der Physiologie* (Berlin etc.: 1953) 55; Mani N., *Die historischen Grundlagen der Leberforschung. Die Geschichte der Leberforschung von Galen bis Claude Bernard* (Basel: 1959), vol. II, 86–90; Drinker C.K., *The Lymphatic System*, Lane Medical Lectures (Stanford: 1942).

<sup>84</sup> Two editions in 1627 and 1628 were not widely mentioned; the spread of the discovery appears to have been fairly slow. It was not until the third edition of Aselli's dissertation was published in 1640 that the question of chylous vessels was put high on the physiologists' agenda.

the heart into the arteries in a given period and the quantity of ingested material must be more or less equivalent. However, the quantity of blood infused into the arteries was much larger than the portion of fresh blood supplied by the ingested food. Among the many examples he drew on as evidence to substantiate his point was the physiology of milk production in the mammae, 'for a cow will give three, four, and even seven gallons and more in a day, and a woman two or three pints whilst nursing a child or twins', if blood and food were balanced.<sup>85</sup> The comparison was a cunning rhetorical strategy that challenged the idea of a balance between blood and milk. A simple mathematical sum could illustrate what seemed logically impossible. The flux of blood could not be supplied by way of nutrition, a telling argument for Harvey's theory of circulation. But it was not Harvey's intention to revise and reformulate the old theories of blood formation in the liver.

With respect to the anatomy of the guts and the splanchnic flows – especially the passage from chyle to the blood – Gaspare Aselli's discovery of the lacteal veins became highly significant. Aselli had argued that such veins originated in the intestines, where they received and conveyed the products of digestion, the chyle. Aselli had unhesitatingly labelled these veins milk vessels (*venas lacteas*). Physical evidence once again had confirmed that any kind of white fluid must be milk, which could not be engendered only at one location inside the body. The idea of blood circulation strengthened the old assumptions about materials moving within the body. Galen had located the product of the first concoction in the stomach, yet medical practitioners following the Hippocratic theory held that, as in the case of lactating men, the white liquor travelled through the body. The lacteals now seemed to be evidence that a complex network of channels existed, sucking and secreting milk and serving as passages from one organ to the next. Thus, the identification of blood circulation was supposed to be applicable to other natural flows inside the body.

The crucial point was the location of the lacteal vessels and 'the journey of the chyle'.<sup>86</sup> Aselli himself believed that the milk veins ended in the liver. Harvey, after learning that Aselli had postulated the existence of the milk veins, opposed this view. He also held that it was not necessary to seek a different channel for transporting chyle to the liver. It was obvious, he said, that chyle was carried from the intestines via the mesenteric veins. But in

---

<sup>85</sup> Harvey, *The Works of William Harvey* 53.

<sup>86</sup> Charleton, *Natural History of Nutrition* 16.

1649 the French anatomist Jean Pecquet (1622–1674) demonstrated that the lacteal veins (which he supposed to be a system of vessels) terminate in a peculiar reservoir, which he named the *thoracic duct*.<sup>87</sup> In consequence, the milk-white liquor did not go to the liver but instead found its way via the lacteals and thoracic duct to the right chamber of the heart. Thus, another doctrine was challenged and the question was raised as to exactly where and how the white juice of digestion was converted into blood.

Within a very short time, several anatomists detected other veins, some with a milky, but even more with a watery, content. The nutritive juice became a 'hot topic' for research, as well-known anatomists like Olof Rudbeck (from 1652), Thomas Bartholin (in 1653), and subsequently a whole generation of anatomists developed a new description of what might be called experimental resorption by mechanical forces.<sup>88</sup> The nutritive mash and fluid of the stomach is pressed into the milk veins by contraction of the intestine muscles; from there it flows by way of suction into the vena mesenterica, the lower surface of the liver, the portal vein, and into the inferior vena cava. Ultimately, this new fascination with the digestive process would lead to a comprehensive description of the lymphatic system.<sup>89</sup> However, more than one and a half centuries would pass before these ideas would become basic concepts of physiology, but that is another story.

### *The hydraulic body of experimental physiology*

Harvey's blood circulation and Aselli's milk veins challenged – albeit unintentionally and only in the long run – existing theories about the manufacture of blood and milk. Both discoveries promoted an epistemology of circulation that changed the 'humoral body' into a 'hydraulic body'. Indeed, it was not until the 1640s and 1650s that anatomists became aware that a fourth kind of vessel (beside arteries, veins, and nerves) existed. Nevertheless, it is obvious that the emerging mechanical concept of circulation changed the art of anatomical dissection. It marked the birth of experimental physiology.<sup>90</sup> Together with the Cartesian explanations of

<sup>87</sup> Mani, *Die historischen Grundlagen* 88.

<sup>88</sup> Cf. Mani, *Die historischen Grundlagen* 87–90.

<sup>89</sup> Cf. Drinker, *The Lymphatic System* 48–56.

<sup>90</sup> See in general Davis, *Circulation Physiology*; Brown, *The Mechanical Philosophy*; The Cartesian body concept is explored by Des Chene D., *Spirits and Clocks. Machine and Organism in Descartes* (Ithaca-London: 2001).

the body machine and the rival doctrines of the physical (iatromechanical) and chemical (iatrochemical) schools of physiology, notions about fluids underwent radical transformations.

From the 1640s on, as vivisection and new technologies of observation and experimentation (e.g. the use of ligature, chemical analysis of fluids or the microscope) gained ascendancy, the 'old' physiology collapsed, and fundamental notions about the humoral body were translated into a physiology of the hydraulic body. This meant, on the one hand, that specific pre-existing descriptions of the fluid and solid parts of the body were reformulated, as for example veins and arteries became tubes, pipes, channels, capillaries, siphons, ducts, and so on, while organs were transformed accordingly into tanks, containers, receptacles, and reservoirs and served as transient spaces or passages. The term *humour* was gradually abandoned, and was replaced with strictly empirical terms such as fluids, juices, liquors. Bodily fluids were heterogeneous fluids, composed of particles of differing size and shape. Fluidity, hence, was a question of the equivalence of the shape of pores and fluid particles.<sup>91</sup>

In light of a new anatomical knowledge of channel networks, the mechanism of secretions or discharges became rather different to that proposed by humoral theory. The inflammatory potential of the breasts, for instance, was no longer due to their absorbency, which enhanced their ability to soak up harmful humours. Rather it was a result of the defective anatomy of channels, the permeability of ducts, and the motion of particles in fluids. Glands became sieves with holes of a particular size that allowed them to separate the material needed from the blood. Vessels were likewise 'capable of encompassing, directing, changing, separating, collecting, and secreting liquids'.<sup>92</sup> Many diseases now were caused by ferments or had to be deduced from chemically-studied processes like ebullition, effervescence, coagulation or 'orgasms of the Blood, on which most Inflammations, Tumours, Pains, and Fluxes of Humours, depend'.<sup>93</sup>

---

<sup>91</sup> The size of particles became extremely important for the understanding of the process of flow. For instance, if larger particles blocked smaller pores or if several different shapes could not pass through a given pore, this would result in material changes that – in the worst case – led to the corruption of the fluids involved. Moreover, not only size and shape but also the position of the particle (thicker or thinner) became crucial, since a cube could only pass through an exactly-sized square hole. See Orland, "The Fluid Mechanics of Nutrition".

<sup>92</sup> Boerhaave Herman, "Oration on the Usefulness of the mechanical Method in Medicine" in *Boerhaave's Orations* (Leiden: 1983) 102.

<sup>93</sup> Floyer Sir John, *The Preternatural State of Animal Humours described, by their Sensible Qualities* (London, Michael Johnson: 1696), preface.

Also important was the insistence that vital motions and transformations of matter should be perceived as a 'legitimate object of mechanical science'.<sup>94</sup> Herman Boerhaave argued in 1703 that the influence of liquids on the body could never have been explored in the same way without knowledge of mechanics. The mechanics (in the sense of hydraulic engineering), mathematical reasoning, and iatrochemistry of the last half century, Boerhaave pointed out, could contribute to the theoretical insights from physiology, and should be viewed as indispensable aids for practitioners. After decades of physiological experiments and sharp controversies between the various schools of mechanical philosophy, the iatrochemical followers of Paracelsus and Helmont, those who sought to revive Epicurean atomism, and the advocates of microscopic studies of the subvisible particles of the body, the ideal Boerhaavian body – which in a way was a synthesis of all these different intellectual developments – seemed to resemble a network anatomy, a system of fluids in communicating vessels. In the Boerhaavian model, the body was a hydraulic machine, and its vital functions that resulted from the interaction of solids and fluids could be demonstrated experimentally.

### *Epilogue*

By the turn of the eighteenth century, physiological research had changed its focus, experimental methods, and instruments. In contrast to humoral physiology, the hydraulic body concept called for a knowledge that preferably had resulted from technological innovations and experimental demonstrations. The urge to categorise organs, vessels and fluids according to a new rational system of hydromechanics became apparent in all centres of physiological research throughout Europe. These new perspectives posed powerful challenges for the humoral system of the body. As traditional theories of organic sympathies and antipathies were abandoned, new analogies based on experimental evidence arose. From the late seventeenth century on, most learned physicians agreed in recognising the merits of experimental experience and accepted the view that there exists no anatomically detectable connection between uterus and breasts, and that one cannot explain the whitening of blood into milk. The centuries-old concept based on the Galenic and Hippocratic theory of humours and

---

<sup>94</sup> Boerhaave, "Oration" 92.

informed by Aristotelian biology seemed to have disappeared. Many physicians claimed that medical practice should no longer be based on 'false conjectures of Antiquity'.<sup>95</sup>

Among many other traditional views, the belief that milk is menstrual blood directed to the breasts lost its power of persuasion. The analogy between menstruation and lactation had outlived its usefulness. Blood and milk were no longer equally important nutriments, and milk no whitened menstrual blood. Most learned physicians would argue that milk is similar to chyle, the intermediate product of digestion. Yet, despite a radical rhetoric of discovery and innovation, in medical practice the older humoral theory – which was widespread, plausible, and well-established – lingered on, in particular because it could be easily understood by practitioners and lay persons. For the broader public, the notion of an affinity between blood and milk was still accepted and survived well into the nineteenth century. People were used to experiencing and describing their internal bodily processes in terms of fluid dynamics; the blood/milk-analogy was just one example of a body concept characterised by the flows and interplays of airs, vapours, liquids, and more solid parts. Thus, one could integrate part of the new physiological theories without eliminating the old concepts. Practitioners such as Johann Storch instead combined the old authoritative knowledge and common narratives with the new theories of hydromechanical physiology. Storch wrote in 1750: 'Milk and blood, in fact, are so close that one rightly can call milk a white blood [...] notwithstanding that we have named blood a red milk'.<sup>96</sup>

---

<sup>95</sup> French physician Jean-Baptiste Denis in 1762, as quoted in Roger, *The Life Sciences* 150.

<sup>96</sup> 'Die Milch ist in der That dem Blut so nahe verwandt, daß man sie mit Recht ein weißes Blut nennen mag [...] gleichwie hinwiederum das Blut billig eine rothe Milch heisset'. Storch Johann, *Theoretische und practische Abhandlung von Kinderkrankheiten* (Eisenach, Gießbach: 1750), vol. I, 318.



### Selective bibliography

- ALBALA K., *Eating Right in the Renaissance* (Berkeley-Los Angeles: 2002).
- ANONYMOUS, *The Art of Nursing. Or, the Method of Bringing up Young Children according to the Rules of Physick, for the Preservation of Health, and Prolonging Life* (London, John Brotherton: 1733<sup>2</sup>).
- ARIKHA N., *Passions and Tempers. A History of the Humours* (New York: 2007).
- ASELLI GASPARE, *De lactibus sive lacteis venis*, ed. with an introduction by P. Franceschini (Milan, Episteme: 1972) (Orig. published posthumously 1727).
- BARTHOLIN THOMAS, *Bartholinus Anatomy. Made from the Precepts of his Father, and from the Observations of all Modern Anatomists. Together with his own*, published by Nich. Culpeper and Abdiah Cole (London, Peter Cole: 1663) (Orig. written in Latin 1641).
- BOERHAAVE HERMAN, *A New Method of Chemistry. Including the Theory and Practice of that Art. Laid down on Mechanical Principles, and accommodated to the Uses of Life*, from the printed edition, by P. Shaw, and E. Chambers (London, J. Osborn and T. Longman: 1727) 180 (Orig. written in Latin 1724).
- , "Oration on the Usefulness of the mechanical Method in Medicine", in *Boerhaave's Orations*, trs./eds. Kegel-Brinkgreve E. – Luyendijk-Elshout A.M. (Leiden: 1983) (Orig. published in 1703).
- BONTEKOE CORNELIS, *Kurtze Abhandlung von dem Menschlichen Leben/ Gesundheit/ Kranckheit und Tod/ In Drey unterschiedenen Theylen verfasst/ Davon das I. Unterricht giebet von dem Leibe [...]. II. Von der Kranckheit/ und derselben Ursachen. III Von denen Mitteln/ das Leben und die Gesundheit zu unterhalten und zu verlängern [...]* (Bautzen Rudolstadt, F. Arnst/ Joh. Rudolph Löwe: 1692) 32 (Orig. written in Dutch 1684).
- BROWN T.M., *The Mechanical Philosophy and the 'Animal Oeconomy'. A Study in the Development of English Physiology in the Seventeenth and Early Eighteenth Centuries* (New York: 1981).
- C[HAMBERLAYNE] T[OMAS] ET AL., *The Compleat Midwives Practice, in the most weighty and high Concernments of the Birth of Man. Containing perfect Rules for Midwives and Nurses, as also for Women in their Conception, Bearing, and Nursing of Children. From the Experience not onely of our English, but also the most accomplishd and absolute Practicers among the French, Spanish, Italian, and other Nations [...]* (London, Nath. Brooke: 1656).
- CHAMBERLEN PETER, *Dr. Chamberlain's Midwife's Practice. Or, a Guide for Women in that high Concern of Conception, Breeding, and Nursing Children. In a plain Method, containing the Anatomy of the Parts of Generation. Forming the Child in the Womb. What hinders and causes Conception. Of Miscarriages and Directions in Labour, Lying-inne, and Nursing Children* (London, J. Clowes: 1665).
- CHARLETON WALTER, *Natural History of Nutrition, Life, and Voluntary Motion containing all the New Discoveries of Anatomist's and Most Probable Opinions of Physicians, concerning the Oeconomie of Human Nature. Methodically delivered in Exercitationes Physico-anatomical* (London, Henry Herringman: 1659).
- CRAIK E.M. (ed./tr.), *The Hippocratic Treatise On Glands* (Leiden-Boston: 2009).
- CRAWFORD P., "Attitudes to Menstruation in Seventeenth-Century England", *Past & Present* 91 (1981) 47–73.
- CRAWFORD P.M., *Blood, Bodies and Families in Early Modern England* (Harlow: 2004).
- CROOKE HELKIAH, *Mikrokosmographia. A Description of the Body of Man, together with the Controversies and Figures thereto Belonging / Collected and Translated out of all the best Authors of Anatomy, especially out of Gasper Bauhinus and Andreas Laurentius* (London, W. Iaggard: 1615).
- DAVIS A.B., *Circulation Physiology and Medical Chemistry in England (1650–1680)* (Lawrence, Kansas: 1973).

- DES CHENE D., *Spirits and Clocks. Machine and Organism in Descartes* (Ithaca-London: 2001).
- DEUSING ANTON, *Exercitatio physiologico-medica de nutritone animalium. Publico examini subiecta in illustri* (Groningen, Bronchorst: 1660).
- DRINKER C.K., *The Lymphatic System*, Lane Medical Lectures (Stanford: 1942).
- FABRICIUS AB AQUAPENDENTE HIERONYMUS, *The Embryological Treatises of Hieronymus Fabricius of Aquapendente*, ed./tr. Adelman H.B. (Ithaca NY, Cornell Univ. Press: 1942) [Orig. published posthumously 1621].
- FILDES V.A., *Wet Nursing. A History from Antiquity to the Present* (Oxford: 1988).
- FISSELL M.E., *Vernacular Bodies. The Politics of Reproduction in Early Modern England* (New York: 2004).
- FLOYER SIR JOHN, *The Preternatural State of Animal Humours described, by their sensible Qualities* (London, Michael Johnson: 1696).
- FÖLLINGER S., *Differenz und Gleichheit. Das Geschlechterverhältnis in der Sicht griechischer Philosophen des 4. bis 1. Jahrhunderts v. Chr.* (Stuttgart: 1996).
- FORRESTER J., *The Physiologia of Jean Fernel (1567)* (Philadelphia: 2003) 565 (Orig. written in Latin 1567).
- FREUDENTHAL G., *Aristotle's Theory of Material Substance. Heat and Pneuma, Form and Soul* (Oxford: 1995).
- GÉLIS J., *History of Childbirth. Fertility, Pregnancy and Birth in Early Modern Europe* (Cambridge: 1991).
- GROEBNER V., "Complexio/Complexion: Categorizing Individual Natures 1250–1600", in Daston L. – Vidal F. (eds.), *The Moral Authority of Nature* (London: 2004) 361–383.
- GROENEVELD JOANNES, *The Grounds of Physick. Containing so much of Philosophy, Anatomy, Chimistry, and the mechanical Construction of a humane Body, as is necessary to the Accomplishment of a Physitian. With the Method of Practice in common Distempers. Extracted from the most eminent Authors, both antient and modern* (London, W. Taylor, J. Osborn, and J. Pemberton: 1715) (Orig. written in Latin 1714).
- GUTERMANN GEORG F., *Dissertatio inauguralis medica de mammis et lacte, in qua status tam naturalis, quam praeternaturalis, huiusque therapia rationalis* (Tübingen, Joseph Sigmund: 1727).
- HARVEY WILLIAM, *Lectures on the Whole of Anatomy*, an annotated Translation of *Prelectiones Anatomiae Universalis* by C.D. O'Malley (Berkeley-Los Angeles: 1961).
- , *The Works of William Harvey*, translated from the Latin by Robert Willis (London: 1847).
- HEYMANNS ISAACUS, *Dissertatio medica inauguralis de aberratione lactis, et morbis ex ea provenientibus, quam annuente summo numine, ex auctoritate rectoris magnifici Bavii Voorda* (Leiden, Theodorus Haak: 1781).
- HICKEY S., "Fatal Feeds? Plants, Livestock Losses and Witchcraft Accusations in Tudor and Stuart Britain", *Folklore* 101, 2 (1990) 131–142.
- KUEFFER WILHELMUS CHRISTIANUS, *Galaktologian seu dissertationem de lacte* (Strasbourg, [s.n.]: 1672).
- LAQUEUR T., *Making Sex. Body and Gender from the Greeks to Freud* (Cambridge, Mass.-London: 1990).
- LEHMANNUS CHRISTIANUS GODOFREDUS, *Dissertatio inauguralis medica de defectu lactis [...] sub praesidio Georgii Wolffgangi Wedelii [...] pro licentia summos in arte medica honores, insignia et privilegia Doctoralia, more maiorum, rite impetrandi* (Jena, Christophorus Krebs: 1699).
- LÉMERY LOUIS, *Traité des aliments* (Paris, Pierre Witte: 1702).
- LLOYD G.E.R., *Aristotelian Explorations* (Cambridge: 1996).
- LONGRIGG J., *Greek Rational Medicine. Philosophy and Medicine from Alcmaeon to the Alexandrians* (London-New York: 2003).
- LONIE I.M., *The Hippocratic Treatises "On Generation" "On the Nature of the Child" "Diseases IV"* (Berlin-New York: 1981).

- LORD A., "The Great Arcana of the Deity': Menstruation and Menstrual Disorders in Eighteenth-Century British Medical Thought", *Bulletin of the History of Medicine* 73, 1 (1999) 38–63.
- MAEHLE A.H. – TROEHLER U., "Animal Experimentation from Antiquity to the End of the Eighteenth Century: Attitudes and Arguments", in Rupke N.A. (ed.), *Vivisection in Historical Perspective* (London-New York: 1990) 14–47.
- MANI N., *Die historischen Grundlagen der Leberforschung. Die Geschichte der Leberforschung von Galen bis Claude Bernard* (Basel: 1959), vol. II.
- MCCLIVE C., "Menstrual Knowledge and Medical Practice in Early Modern France, c. 1555–1761", in Shail A. – Howie G. (eds.) *Menstruation. A Cultural History* (Hampshire: 2005) 76–89.
- MOFFETT THOMAS, *Healths Improvement. Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of food used in this nation, corrected and enlarged by Christopher Bennet* (London, Newcomb for Samuel Thomson: 1655) 119–120 (Orig. written ca. 1595).
- MURALT JOHANNES, *Kinder-Büchlein Oder Wolgegründeter Unterricht/ Wie sich die Wehe-Muttern/ und Wartherinnen gegen schwangern Weibern in der Gebuhr; gegen denen Jungen Kindern und Säuglingen aber noch der Gebuhr zuverhalten haben* Muralt (Zurich, Gessner: 1689).
- NEEDHAM J., *A History of Embryology* (Cambridge: 1959).
- NEEDHAM WALTER, *Disquisitio anatomica de formato foetu* (London, Gulielmus Godbid: 1667).
- NUTTON V., *Ancient Medicine* (London: 2004).
- ORLAND B., "The Fluid Mechanics of Nutrition: Herman Boerhaave's Synthesis of Seventeenth-Century Circulation Physiology", in Orland B. – Spary E. (eds.), "Assimilating Knowledge: Food and Nutrition in Early Modern Physiologies", Special Issue of *Studies in History and Philosophy of Biological and Biomedical Sciences* (Cambridge), 44 (2012) (Epub 2011, Dec. 2).
- PASTER G.K., *Humoring the Body. Emotions and the Shakespearean Sage* (Chicago: 2004).
- , *The Body Embarrassed. Drama and the Disciplines of Shame in Early Modern England* (Ithaca, NY: 1993).
- PILLOUD S. – LOUIS-COURVOISIER M., "The Intimate Experience of the Body in the Eighteenth Century. Between Interiority and Exteriority", in *Medical History* 47 (2003) 451–472.
- POMATA G., "Menstruating Men. Similarity and Difference of the Sexes in Early Modern Medicine", in Finucci V. – Brownlee K. (eds.), *Generation and Degeneration. Tropes of Reproduction in Literature and History from Antiquity through Early Modern Europe* (Durham-London: 2001) 109–152.
- PROSPERI L., "Les fraises d'Eve. Le désir alimentaire féminin d'après le discours médical français au début de l'époque moderne", in Duhart Frédéric (ed.), *Anthropologie historique du corps* (Paris: 2006) 253–267.
- RAMAZZINI BERNARDINO, *Health Preserved. In two Treatises, I. On the Diseases of Artificers [...]*, translated and enlarged, with an appendix, by R. James (London, John Whiston, and John Woodyer: 1750<sup>2</sup>) (Orig. written in Latin 1700).
- RIOLAN JEAN, *A sure Guide, or, the Best and Nearest Way to Physick and Chyrurgery that is to say, the Arts of Healing by Medicine and manual Operation. Being an Anatomical Description of the Whole Body of Man and its Parts. With their Respective Diseases demonstrated from the Fabrick and Vse of the Said Parts. In Six Books [...]*, written in Latin by Johannes Riolanus [...]; Englished by Nich. Culpeper (London, Peter Cole: 1657).
- , *Les oeuvres anatomiques de Me. Jean Riolan, conseiller, medecin, et professeur du roy en anatomie et en pharmacie, reveuës et augmentees d'une cinquiemes partie en cette édition* (Paris, Denis Moreay: 1629), vol. III.
- ROGER J., *The Life Sciences in Eighteenth-Century French Thought*, tr. Benson K.R. (Stanford, CA: 1997).

- ROTHSCHUH K.E., *Geschichte der Physiologie* (Berlin etc.: 1953).
- ROWLEY W., *A Practical Treatise on Diseases of the Breasts of Women* (London, F. Newberry: 1772).
- RUEFF JACOB, *De conceptu et generatione hominis, lib. primus* (Frankfurt, Petrus Fabricus: 1580).
- RUESTOW E.G., "The Rise of the Doctrine of Vascular Secretion in the Netherlands", in *Journal of the History of Medicine and Allied Sciences* 35 (1980) 265–287.
- SCHOENFELDT M.C., *Bodies and Selves in Early Modern England. Physiology and Inwardness in Spenser, Shakespeare, Herbert, and Milton* (Cambridge etc.: 1999).
- SCHREINER K., *Maria. Leben, Legenden, Symbole* (Munich: 2003).
- SHAIL A. – HOWIE G. (eds.) *Menstruation. A Cultural History* (Hampshire: 2005).
- SHARP JANE, *The Midwives Book, or the Whole Art of Midwifry discovered*, ed. Hobby E. (Oxford: 1999).
- SIRAISI N.G., *Medieval and Early Renaissance Medicine. An Introduction to Knowledge and Practice* (Chicago, Il. etc.: 1990).
- SMITH J.E.H., *The Problem of Animal Generation in Early Modern Philosophy* (Cambridge: 2006).
- STAEHELIN JOHANN JACOB, *De lactis defectu positiones [...] pro summis in arte medica honoribus ac privilegiis doctoralibus, rite solenniterque consequendis, publico examini submitti [...]* (Basel, Iacob Bertschi: 1669).
- STOLBERG M., "A Woman down to her Bones: The Anatomy of Sexual Difference in the Sixteenth and Early Seventeenth Centuries", *Isis* 94 (2003) 274–299.
- , "Deutungen und Erfahrungen der Menstruation in der Frühen Neuzeit", in Mahlmann-Bauer B. (ed.), *Scientiae et artes. Die Vermittlung alten und neuen Wissens in Literatur, Kunst und Musik* (Wiesbaden: 2004), vol. 2, 913–931.
- , *Die Harnschau. Eine Kultur- und Alltagsgeschichte* (Cologne etc.: 2009).
- , *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (Cologne etc.: 2003).
- , "Menstruation and Sexual Difference in Early Modern Medicine", in Shail A. – Howie G. (eds.) *Menstruation. A Cultural History* (Hampshire: 2005) 90–101.
- , "The Monthly Malady: A History of Pre-Menstrual Suffering", *Medical History* 44 (2000) 301–322.
- STORCH JOHANN, *Theoretische und practische Abhandlung von Kinderkrankheiten* (Eisenach, Gießbach: 1750), vol. I.
- SWIETEN GERARD VAN, *Commentaries upon Boerhaave's Aphorisms Concerning the Knowledge and Cure of Diseases* (Edinburgh, Charles Elliot: 1776), vol. VIII.
- VERDIER Y., *Façon de dire, façon de faire. La laveuse, la couturière, la cuisinière* (Paris: 1979).
- VESALIUS ANDREAS, *On the Fabric of the Human Body. A Translation of de humani corporis fabrica libri septem, Book V. The Organs of Nutrition and Generation*, tr. by William Frank Richardson in coll. with John Burd Carman (Novato CA: 2007) [Orig. written in Latin 1543].
- VESLING JOHAN, *The Anatomy of the Body of Man. Wherein is Exactly Described every Part thereof, in the same Manner as it is Commonly Shewed in Publick Anatomies* (London, Peter Cole: 1653) (Orig. written in Latin 1647).
- WEAR A., *Knowledge and Practice in English Medicine, 1550–1680* (Cambridge etc.: 2000).
- WHARTON THOMAS, *Adenographia. Sive Glandularum totius Corporis Descriptio* (Amsterdam, Joannis Ravenstein: 1659).
- WILKIN S. (ed.), *Sir Thomas Browne's Works. Including his Life and Correspondence* (London: 1835), vol. 4.
- WILLIS THOMAS, Dr. *Willis's Practice of Physick, being all the medical Works of that renowned Physician. Containing these ten several Treatises* (London, T. Dring, C. Harper, and J. Leigh: 1681).
- WITTICH JOHANNES, *Vade Mecvm. Das ist. Ein Künstlich New Artzneybuch, so man stets bey sich haben vnd führen kan, In fürfallender Noth sich Hülff daraus zuerholen, wieder*

*allerhand Kranckheit deß Menschlichen Leibes, vom Häupt an biß auff die Fußsolen [...] In gewisse Capitel vnnd richtige Ordnung gebracht [...] Auch zum Anfang ein vnterricht gesetzt, wie man durchs gantze Jahr gute Gesundheit erhalten möge. Sampt eines vornehmen erfahrenen Mönchs Experimentlein* (Leipzig, Bartholomaei Voigt: 1600).

ZORACH R., *Blood, Milk, Ink, Gold. Abundance and Excess in the French Renaissance* (Chicago-London: 2005).

PART THREE

SWEAT AND SKIN





## THE “BODY WITHOUT SKIN” IN THE HOMERIC POEMS

Valeria Gavrylenko

### *Summary*

This article focuses on the affected body in the Homeric poems and on its relations with the so called ‘inner’ and ‘outer’ world, with psychic and physical ‘intrusions’ that threaten bodily integrity. The image of *chrôs* is an illustrative example of how problematic any differentiation between the exterior and the interior may be. *Chrôs* represents a perfect model of the affected body with no (human) skin, if the skin is seen as an envelope, an external body part detachable from the whole body (that is animal *derma* and *rhinos*), and a barrier between the ‘outer’ and the ‘inner’, between surface and depth. When pierced, consumed, liquified, softened in pain, fear, suffering and joy, or penetrated by spears, the Homeric hero’s *chrôs* constitutes a kind of unity with the ‘inner organs’. This unity consists in the similarity of *texture* of organic entities and *chrôs*, and seems to eliminate any difference between the ‘outer’ and the ‘inner’ body. Subject to various forms of deformation, open to any influence, Homeric *chrôs* could be described as ‘body without skin’, while *derma* and *rhinos* have not yet definitively become the human skin of the heroic body.

The ‘corporeal’ theme is one of the most important in Homeric epic. Although it is treated by contemporary scholarship in various ways, the subject remains open for further investigation. Homeric language possesses a rich vocabulary with regard to the ‘body’ and the ‘corporeal’, and the reader finds a range of diverse terms for ‘body’, none of which match contemporary notions of the human body. Perhaps for this reason, one could say that the notion of the body is beyond Homer’s understanding, a proposition that would be both true and false. The most radical view on the problem could be formulated as being that there is no ‘body’ in the Homeric epics, and there is no ‘not-body’.<sup>1</sup> This briefly summarises research over the last fifty years on the Homeric hero’s ‘not-body’ – psychic processes, (organs of) consciousness, identity, ‘I’, soul, etc.<sup>2</sup> The difficulty

---

<sup>1</sup> To be more precise, ‘in Homer there is no clear body – one soul dichotomy’, Renehan R., “The Meaning of ΣΩΜΑ in Homer: A Study in Methodology”, *California Studies in Classical Antiquity* 12 (1979) 269–282, 279.

<sup>2</sup> For an overview of the state of Homeric studies in this area, see Clarke M., *Flesh and Spirit in the Songs of Homer. A Study of Words and Myths* (Oxford: 1999).

of distinguishing between 'body' and 'not-body' is, in other words, a difficulty of perceiving the difference between the so-called psychic/mental and somatic phenomena 'within' the Homeric man. Both are more or less 'corporeal'/'physiological' on the one hand, and 'mental' on the other. My purpose is not to demonstrate either the existence or the absence of the concept of the 'body' in Homer (nor that of the concept of soul or spirit). I would instead aim at a description, one that is both delicate – as delicate as is the subject itself – and accurate, of the matter that is too crudely called the 'body', which in Homer is represented in a much more sophisticated way.

I will pay particular attention here to the Homeric word *chrôs*, which has remained until recently overshadowed by *sôma*, *demas*, *melea* and *guia*, words which are commonly interpreted as 'body'. Statistically, in Homer *chrôs* occurs most frequently and is the most fruitful field to be explored. Scholars often prefer the bodily plurality represented by *melea* and *guia*, embodied by the live warrior's body. Such a plurality is opposed to *sôma* and *nekus/nekros*, the dead body or corpse that is the manifestation of the hero's acquisition of his bodily unity. This paradigm of a fragmented body in Homer was first noted by Bruno Snell in his understanding of Homeric man as an aggregate of discrete parts.<sup>3</sup> *Sôma*, which is never used in the poems to refer to the living body, is only a later interpretation of bodily joints and sinews, *melea* and *guia*.

A recent study on the subject by the Swiss scholar Guillemette Bolens<sup>4</sup> developed in a detailed way Snell's ideas about the plurality of the Homeric body, whilst at the same time introducing a differentiation, or rather two kinds of 'body logic': one of the joints, called 'articulate', and another of the envelope. When the *Iliad* represents heroic deaths through detailed depictions of injured body parts where disrupted joints and tendons play a crucial role, the priority is to be given, according to Bolens, to the 'articulate body' logic ('logique du corps articulaire'). The view that perceives the body as a unit or 'envelope' is more common in later Greek culture, of which Plato is a brilliant spokesman.<sup>5</sup>

<sup>3</sup> Snell B., *The Discovery of the Mind in Greek Philosophy and Literature* (New York: 1982 [1946]).

<sup>4</sup> Bolens G., *La logique du corps articulaire. Les articulations du corps humain dans la littérature occidentale* (Rennes: 2000).

<sup>5</sup> Bolens G., "Homeric Joints and the Marrow in Plato's *Timaeus*: Two Logics of the Body", *Multilingua* 18, 2/3 (1999) 149–157.

The view of Homeric man as constituting multiple parts – an assumption about the absence of a notion of the 'body' in epic and, consequently, about the use of a range of words (some of them used in the plural) that can now be interpreted as 'body' – may partially be explained by the nature of the poems and the processes of composition, performance and diffusion in which they were re-created. The Homeric poems were composed in the context of an oral culture 'from the early second millennium into the middle of the eighth century in the first millennium'.<sup>6</sup> Performed by court singers, *aoidoi*, for the military aristocracy in palaces or, later, by rhapsodes in front of a wider public, they existed in quite a fluid and mobile form. The Homeric epic was brought together and fixed in writing for the first time after the middle of the sixth century BC. Orality and the later introduction of literacy played significant roles in the composition of the *Iliad* and the *Odyssey* which, according to the analysts, represent an amalgamation of the texts created at different places and different times. Chronology and geography thus make the poems multiple, in form as well as in content. This fact leads to both the epic hero and the body being represented by multiple images. Bolens strongly links orality and corporeality. According to her, mobility is a crucial factor both for the oral culture and the body image typical for this culture. Oral tradition forms an articulate body where bodily members and joints translate the idea of mobility.<sup>7</sup>

While Snell's theory remains, in its multiple variations, predominant, Homeric language still encourages the questioning and transgression of the dichotomies mentioned above. First of all, because our modern structure of thought and understanding of the body reduces a diverse Homeric corporeal lexicon into a rather pale spectrum of meanings, some of the meanings of the words are retained, while others remain neglected. In my opinion, the study of *chrôs* as one of the Homeric 'untranslatables' may demonstrate the diversity and interpretative difficulty that Homeric language and epic perception of the body is apt to show. At the same time, I would stress that this study does not intend to push aside the idea of body as an aggregate in Homer, but rather to illustrate, through analysing *chrôs* (and its 'family'), the multiplicity of bodily images in epic, among which the body-aggregate is not necessarily the most dominant. The 'body' can

<sup>6</sup> Nagy G., *Homeric Questions* (Austin: 1996) 42.

<sup>7</sup> Bolens G., "The Limits of Textuality: Mobility and Fire Production in Homer and *Beowulf*", *Oral Tradition* 16, 1 (2001) 107–128.

be assessed with different criteria, beyond multiplicity and unity or life and death (*chrôs* mixes these last two notions, creating a sense of *mors incerta* in Homeric epic). We could use, for instance, criteria of depth/surface or interior/exterior, which, as we shall see, are themselves vague (this is crucial and inevitable for Homeric poems) and often contradicted by the ways *chrôs* is used in the poems.<sup>8</sup> In this paper I will demonstrate the reversibility and frequent indistinguishability of bodily surface and depth manifested by *chrôs*, through showing its semantic proximity to flesh, *sarx*, and its difference from *derma* and *rhinos*, skin (of an animal) separable from the (animal) body, and finally its liquidity, common both for *chrôs* and the internal 'organs'.

I will often equate *chrôs* with the 'body' in my analysis, with the following important proviso: it is 'body without skin', the quotation marks stressing the conditionality of any term that we use in our analysis of Homeric understanding of the 'body', a concept that is absent in the *Iliad* and the *Odyssey* due to the abundance of terms used to denote the body. Homeric language, with its semantic flexibility, allows this equation between *chrôs* and the body. It is our own notion of the 'body', incompatible with Homeric assumptions about it, which acquires, due to this intentional equation, unexpected semantic nuances. In answer to the question 'Is there a (concept of) body in Homer?' my answer would be 'yes': *chrôs*, 'body without skin'.

### *Between sarkes and derma (rhinos)*

Homeric *chrôs* is usually understood as 'skin', or 'envelope', 'surface', the 'outer boundary of the human body'. These terms are used by a number of influential modern scholars: B. Snell, J.-P. Vernant and G. Bolens. However, such an interpretation of *chrôs* as an exterior was first proposed by the Pythagoreans and, after centuries of transmission of Homer and critical work on him, firmly integrated into contemporary academic thought. According to the Pythagoreans, *chroia* is a surface, a bodily exterior.<sup>9</sup>

<sup>8</sup> In terms of methodology, I consider it necessary to underline this semantic flexibility of the Homeric lexicon, its 'contradictoriness' and persistent transgression of those inescapable (because these are our analytic instruments) criteria with which a modern scholar treats historical and cultural phenomena.

<sup>9</sup> Pseudo-Plutarchus, *Placita philosophorum* 883C4–5 οἱ Πυθαγορικοὶ χροῖαν ἐκάλουν τὴν ἐπιφάνειαν τοῦ σώματος.

At the same time, it is also interpreted as 'body', 'flesh', and sometimes 'colour'. Indeed, 72 cases in the *Iliad* and 44 in the *Odyssey*<sup>10</sup> problematise any distinction within the concept of *chrôs* between flesh and skin, between surface and depth. If some occurrences suggest that *chrôs* is close to the modern notion of skin as surface (which has now become problematic as well), others invite the reader to feel its apparent depth.

In this regard, it is useful to refer to Galen, who provides a summary of what appears implicit in Homeric poems: 'The Ionians give the name *chrôta* to the fleshy part of our body: skin (*derma*) and muscles (*mues*), in addition to the membranes and internal organs (*splanchna*). What relates to the bones is not called *chrôta*'.<sup>11</sup> The syncretical character of *chrôs* is therefore evident: it is body and skin together, and what is important is not the opposition of surface to depth, but rather a sort of affinity of *chrôs* to the fleshy parts of the body, an affinity that allows us to identify it as a 'body without skin' because *derma*, mentioned here by Galen, is not yet 'appropriated' by the human body in the Homeric epic.<sup>12</sup>

Homeric depictions of *chrôs* suggest that there is no constant meaning of the word, and that it changes from context to context, oscillating between 'opposites' – surface and depth. *Chrôs* is sometimes as 'thick' as to reach the bones: *antikru chroa te rêksô sun t'oste' araksô*, 'I will tear your body and at the same time break your bones' (*Il.* 23.673). In some cases, however, 'depth' or 'superficiality' are not so evident: *amph' osteo-phi chrôs* in *Od.* 16.145; *chroa kalon eni gnampitoisi melessi*, *Od.* 13.398, 430; *amphi peri chroa inesin êde melessin*, *Il.* 23.191. Following these examples, it is difficult to say whether flesh or skin are to be understood by *chrôs*, but – and this seems to be more important – it might not be a concern for the poet(s), because the term is interchangeable with *sarx* and is never

<sup>10</sup> Homer, *Ilias* 04.130, 137, 139, 237, 510; 5.337, 354, 858; 7.207; 8.43, 298; 9.596; 10.575; 11.352, 398, 437, 457, 573, 574; 12.427, 464; 13.25, 191, 241, 279, 284, 340, 440, 501, 553, 574, 640, 649, 830; 14.25, 164, 170, 175, 187, 383, 406, 456; 15.315, 316, 317, 534; 16.504, 761, 814; 17.210, 571, 733; 19.27, 33, 39, 233; 20.100; 21.70, 168, 398, 568; 22.286, 321, 322; 23.67, 191, 673, 803, 805, 819; 24.19, 414; *Odyssea* 2.376; 4.749, 750, 759; 5.455; 6.61, 129, 220, 224; 11.191, 529; 13.398, 430; 14.24, 506; 15.60; 16.145, 175, 182, 210, 457; 17.48, 58, 203, 338; 18.172, 179; 19.72, 204, 218, 232, 237, 263; 21.412; 22.113; 23.95, 115, 237; 24.44, 156, 158, 467, 500.

<sup>11</sup> Galenus, *In Hippocratis librum de fracturis commentarii* 2.9 (18b.435.7–10 K.). 'Χρώτα καλοῦσιν οἱ Ἴωνες, ὃ ἦν τοῦ σώματος ἡμῶν σαρκώδες, ἐν ᾧ μάλιστα γένηται τὸ δέρμα καὶ οἱ μύες εἰσιν, ἐφεξῆς δὲ οἱ ὑμένες καὶ σπλάγχνα. τὸ δὲ τῶν ὀστέων γένος οὐκ ὀνομάζουσι χρώτα'.

<sup>12</sup> Jackie Pigeaud draws on the Galenic view of Ionian *chrôta* and its profoundness, stressing (and at this point his position is in line with the understanding of *chrôs* by contemporary scholars) that *chrôs* is a 'superficial body'. See Pigeaud J., "La peau comme frontière", *Micrologus. La pelle umana. The Human Skin* 13 (2005) 23–53, 28.

associated with *derma* and *rhinos*, which in the poems designate mostly animal skin or hide.

The functionally synonymous nature of different words used to describe similar phenomena in the identical passages helps to locate *chrôs* upon or around the warrior's bones and limbs, and to define its 'anatomical' characteristics. Such is the case of *sarx*, *sarkes* which enters into a functional synonymic relationship with *chrôs* in the passages just mentioned, with an uncertain meaning of *chrôs*. *Chrôs* is similar to *sarx* when *sarx*, *sarkes* is opposed to the bones: *ou gar eti sarkas te kai ostea ines echousin*, 'joints do not wear flesh and bones any more', *Od.* 11.219; *sarkes de peritrome-onto melessin*, 'flesh trembled around the members', *Od.* 18.77; the Cyclops Polyphemus was so hungry as to eat not only the internal organs of the flesh, *enkata te sarkas*, but bones full of marrow as well, *ostea mueloenta*, *Od.* 9.292–293. *Chrôs*, close in meaning to 'flesh' and 'meat', is thus interchangeable with *sarx*.

Apart from *sarx*, there is a curious correlation between *chrôs* and *derma*, *rhinos*. This time, they are not functionally synonymous. Usually, *derma* and *rhinos* are used *not* in relation to the human body, but to the 'non-human'. According to Pigeaud, '*derma* c'est la dépouille, la peau de l'écorché. En général, il faut le dire, une peau de bête. Un synonyme de *derma* est *rhinos*'.<sup>13</sup> *Derma*, derived from the verb *derô*, in most cases means the hide of an animal.<sup>14</sup> *Derma* is distinctive due to the fact that it can be detached from the whole animal. It can then be processed and used as an element of armour, clothes, and bedding. The same can be said of *rhinos*. *Il.* 16.341 offers the only exception in the *Iliad*. Here *derma* is applied to the human 'écorché': decapitated by Peneleos, Lyco's head hangs to one side; only *derma* holds it.<sup>15</sup> In the *Odyssey*, *derma* is still used for the detached and sometimes processed skin of animals. Again, as in the *Iliad*, there is an exception in the *Odyssey* concerning the use of *derma*. This exception does not change the meaning of *derma*; it only transfers it to the human body. *Od.* 13.429–432 depicts Odysseus' transformation by Athena where the hero is shown covered with the *derma* of a very old man (*palaïou gerontos*), while his own *chrôs* is dried up:

<sup>13</sup> Pigeaud, "La peau comme frontière" 23–24.

<sup>14</sup> Hom. *Il.* 6.117, 9.548, 10.23, 177; *Od.* 2.291, 4.436, 440, 782; 8.53; 13.436; 14.24, 50, 519; 22.362.

<sup>15</sup> ἔσχεσε δ'οἶον | δέρμα, παρήερθη δὲ κάρη.

So saying, Athene touched him with her wand. She withered the fair flesh (*chroa*) on his supple limbs, and destroyed the flaxen hair from off his head, and about all his limbs she put the skin (*derma*) of an aged old man.<sup>16</sup>

Scholars debate whether the goddess indeed *transforms* Odysseus or only *dresses* him with an old man's skin, quite a popular motif in ancient literature. Gregory Nagy accepts the 'metaphorical' interpretation of such scenes, which for him represent 'the traditional theme of equating one's identity with one's "hide"'.<sup>17</sup> Nagy then argues that the Greek *sakos*, 'cowhide-shield', 'besides meaning "body" [...] is also regularly used to designate "person, self, one's own self"'.<sup>18</sup> A different position is adopted by C.M. Bowra concerning the problem of 'complete' transformations of mythological characters (such as Actaeon). According to him, '*derma* is not the same as *demas*'.<sup>19</sup> I would add that *derma* evidently is not the same as *chrôs* either. A good example of such an imbalance or difference is Heracles, a superhero who wears the lion's hide *and* is skinless at the same time, that is, fatally defective.<sup>20</sup>

It is clear that the *derma* of an old man is alien to Odysseus' body (*chrôs*). In its meaning, it is identical to other occurrences of *derma* as an animal hide, an envelope, a body part which may be detached from the body.

In this context it is worth mentioning another metamorphosis experienced by Athena's protégé. In book 16, Odysseus meets Telemachus, and just before the son recognises his father, Athena transforms 'old' Odysseus into an essence of youth and divine beauty. Telemachus exclaims:

Of other sort thou seemest to me now, stranger, than awhile ago, and other are the garments thou hast on, and thy *chrôs* is no more the same (*Od.* 16.181–182).<sup>21</sup>

A.T. Murray's translation of *chrôs* as colour omits the play on words created by the previous scene of Odysseus' transformation in book 13, a play

<sup>16</sup> "Ὡς ἄρα μιν φαμένη ῥάβδῳ ἐπεμάσσατ' Ἀθήνη. | κάρψεν μὲν χροά καλὸν ἐνὶ γναμπτοῖσι μέλεσσι, | ξανθὰς δ' ἐκ κεφαλῆς ὄλεσε τρίχας, ἀμφὶ δὲ δέρμα | πάντεσσιν μελέεσσι παλαιῷ θῆκε γέροντος..."

<sup>17</sup> Nagy G., *Greek Mythology and Poetics* (Ithaca-London: 1990) 264.

<sup>18</sup> Nagy, *Greek Mythology* 264.

<sup>19</sup> Bowra C.M., *Greek Lyric Poetry. From Alcman to Simonides* (Oxford: 1961) 100.

<sup>20</sup> On Heracles' kairotic skinlessness related to his 'disease(s)' see the illuminating article by Staden H. von, "The Mind and Skin of Heracles: Heroic Diseases" in Gourevitch D. (ed.), *Maladie et maladies, histoire et conceptualisation. Mélanges en l'honneur de Mirko Grmek* (Geneva: 1992) 131–150.

<sup>21</sup> "Ἀλλοῖός μοι, ξεῖνε, φάνης νέον ἢ ἐπάροιθεν, | ἄλλα δὲ εἴματ' ἔχεις, καὶ τοι χρώς οὐκέθ' ὁμοῖος'.



between the *chrôs* of the hero and the *derma* upon (or around, *amphi*) him. J.-P. Vernant is more precise: for Telemachus, Odysseus reappears 'with totally different skin'.<sup>22</sup> Because Telemachus is ignorant about the former metamorphosis of the stranger with the old *derma* around him, he wrongly equates *derma* with *chrôs*, taking it for the stranger's 'own', and for this reason he calls it *chrôs* instead of *derma*. J. Pigeaud emphasises this nuance that *chrôs* is 'co-née avec son porteur; je veux dire qu'on ne peut pas la revêtir comme le *derma*'.<sup>23</sup>

Synonymous with *derma*, *rhinos* (pl. *rhinoi*) designates an animal hide,<sup>24</sup> a material from which shields are made (usually oxhide). However, one can see how *rhinos* is flayed or torn off the human body. In *Il.* 5.308, a rock thrown by Tydeus at Aeneas 'tore the skin away'.<sup>25</sup> In the *Odyssey* the number of similar cases increases: *rhinoi*, slightly wounded or torn off the bodies by stones, rocks, weapons, are used to designate the human skin: 5.426, 435, 14.134, 22.278. In *Od.* 12.45–46 *rhinoi* rot around the bones of victims who had died listening to the song of the Sirens. To the scholiast, these are skins: 'skins putrefy around the bones'.<sup>26</sup> Then, *akrên rhinon* touched by the javelin in *Od.* 22.278 is understood as the 'outer surface' (skin) of the body.<sup>27</sup>

Other examples (cf. *Il.* 23.673 and *Od.* 5.426; *Od.* 12.46, and 16.145) demonstrate the interchangeability of *rhinoi* and *chrôs*. Both 'skin' and 'body', or 'flesh' could be read there. At the same time, those several occurrences in the *Odyssey* of *rhinos* designating not exclusively animal skin, but also human skin detached or torn from the heroic body (*Od.* 5.435, 14.134, 22.278), allow us to offer a hypothesis about the appearance of the human skin in the *Odyssey*. If the *Odyssey*, a younger poem than the *Iliad*, presents more examples of *rhinos* as the human skin, then it indicates a shift in Homeric assumptions about the human body, a change of a body logic in the redaction of the *Odyssey* which consists in the body's acquisition of its 'own' skin.

Although the *Odyssey* presents only slender evidence for the birth of the concept of human skin, which complicates the development of my

<sup>22</sup> Vernant J.-P., *Mortals and Immortals. Collected Essays* (Princeton-New Jersey: 1991) 39.

<sup>23</sup> Pigeaud, "La peau comme frontière" 28.

<sup>24</sup> Hom. *Il.* 4.447, 7.474, 8.61, 10.155, 262, 334, 12.263, 13.406, 804, 16.636, 20.276, *Od.* 1.108, 5.281, 12.395, 423. Πινός, ῥίνοι are used for the nose and nostrils as well: *Il.* 13.616, 19.39.

<sup>25</sup> ὦσε δ' ἀπὸ ῥινὸν τρηχὺς λίθος'.

<sup>26</sup> *Scholia Graeca in Homeri Odysseam Q ad 12.46* 'περὶ δὲ τὰ ὁστέα τὰ δέρματα σήπονται'.

<sup>27</sup> *Scholia in Odysseam V ad 22.278* 'τὴν ἔξωθεν ἐπιφάνειαν τοῦ σώματος'.

initial proposal, it is important that it is articulated here in the context of my analysis of *chrôs* as 'body without skin'. I see here no contradiction, just as there is no contradiction in the case of 'skinless' Herakles covered with the lion's hide, and also because the Homeric epic is not a *system of coherent* representations, but a 'network' of their multiple disruptions and strata. It shows the body not only in flux with the world but also in flux in time. *Rhinos* as the human skin is here only the seed of a concept which does not, however, enter into circulation even within the Hippocratic Corpus, where it is rarely used. Therefore, the human skin that emerges in the *Odyssey* does not overshadow *chrôs*, but, on the contrary, makes its skinlessness more obvious.

*Chrôs*, *sarx* and *derma/rhinos* form a curious triangle of intricate relationships. However, *chrôs* seems to prevail in this '*chrôs*-family'.<sup>28</sup> If *derma* and *rhinos* sometimes designate the human skin in Homer, they are mainly associated with animal hide. And yet, even when applied to the human body, *rhinos*, when opposed to the bones (as in *Od.* 12.45–46), may be too close to *sarx* in meaning to claim its purely 'dermatological' (in the Homeric sense of *derma*) meaning. Moreover, a number of spatial prepositions like *amphi* and *peri* depict *chrôs* as an envelope, a cocoon, an exterior of the body. But this image of a cocoon, a container, is inseparable from another one where the prepositions *antikru* and *dia* visualise *chrôs* as the fleshy body with depth and surface fused together.

*Chrôs* represents depth and exteriority of the body at the same time. But modern scholars stress its exteriority, thus following the Pythagoreans' understanding of the Homeric man. Bruno Snell argues:

[...] *chrôs* is the skin, not the skin as an anatomical substance, the skin which can be peeled off – that is [...] *derma* – but the skin as surface, as the outer border of the figure of man, as the foundation of colour, and so forth. In point of fact, however, *chrôs* is often used in the place of 'body'.<sup>29</sup>

For J.-P. Vernant too the significance of *chrôs* is focused on its superficiality: 'l'enveloppe extérieure, la peau, la surface de contact avec soi et avec l'autre, comme aussi la carnation, le teint'.<sup>30</sup> The terms themselves used to explain *chrôs* – in particular, surface – should not be taken for

<sup>28</sup> An allusion to the '*thumos*-family' of Michael Clarke in his monograph *Flesh and Spirit in the Songs of Homer. A Study of Words and Myths* (Oxford: 2000).

<sup>29</sup> Snell B., *The Discovery of the Mind in Greek Philosophy and Literature* (New York: 1982) 6.

<sup>30</sup> Vernant J.-P., *L'Individu, la mort, l'amour. Soi-même et l'autre en Grèce ancienne* (Paris: 1989) 11.

granted, but should be used with greater precision. It is possible to accept the idea of Snell and Vernant about superficiality and exteriority of *chrôs* only if an important nuance is taken into account: its depth, pointed out already by Galen. I also agree that *chrôs* is a border, an area of contact with the outer world which implies that there is a distinction, a disruption, between the human and the outer world. *Chrôs* is exactly what establishes this difference. But in the *Iliad*, and often in the *Odyssey*, this border is depicted as eliminated. That is, *chrôs* exists only in the state of disruption between the human and the world, the state of intrusion of one into another. It is intrusion and violation of borders that give birth to this fleshy body.

Concerning the 'self' and 'other' to which Vernant appeals, these notions and the distinction between them seem somewhat anachronistic, perhaps even modern-eurocentrist. It is barely possible to demonstrate a direct *textual* correlation between *chrôs*, 'self', and 'other' in the *Homeric poems*. This is primarily because in epic there is no equivalent or no (single?) word for 'self', a point which has itself become the subject of a vast body of research. I would not venture to engage with the problem of Homeric 'self'/'other' in its relation to *chrôs*. To me, the use of this notion here would necessitate different conceptual vocabulary and analysis on another level. Besides, when I use the terms 'hero' or 'human', 'outer' or 'external', I would not substitute any of them by 'self' and 'other'.

Nicole Loraux's views are close to my own understanding of the heroic body represented by *chrôs*. It is irrelevant for Homer, she argues, to differentiate between skin and flesh within the term *chrôs*. What makes a difference is bodily openness and vulnerability. The heroic body is a body-wound which appears just at the moment its life is threatened. In fact, the danger to which *chrôs* is subject *creates* and engenders this body-wound. There is no body (*chrôs*) until it is penetrated, cut, dismembered, dried out, wasted away, mutilated, and so forth.<sup>31</sup>

Such an approach invites us to perceive *chrôs* as a tangible substance that always finds itself not only in a superficial contact with, but also in a profound mixture with, the 'outer' world. This circumstance, too, may explain the absence of the Homeric notion of the human skin if its function is to serve as a barrier, a border, a cover protecting the body from outside influences. In Homeric epic this function is performed by the

---

<sup>31</sup> Loraux N., *The Experiences of Tiresias. The Feminine and the Greek Man* (Princeton: 1995) 96–97.

animal hide (*derma, rhinos*) as the heroic body is generally deprived of his own 'hide'.

Epithets accompanying *chrôs*, *chroa* emphasise its specific subtlety, or delicacy: *leukon* (*Il.* 11.573, 15.316), *terena* (*Il.* 4.237, 13.553, 14.406), *kalon* (*Il.* 5.858, 11.352, 21.398, 22.321, 23.805, *Od.* 19.263).<sup>32</sup> The idea of the vulnerability of the living heroic body is even further condensed in the word *trôtos*, used once for Achilles' body in *Il.* 21.568.<sup>33</sup> If the live body of the Homeric hero is *trôtos*, then *empedos* denotes the dead body of the most prominent heroes whose bodies are to be preserved safe and sound before the funerary rituals are performed (e.g., *Il.* 19.33, 39). *Chroa leirioenta*, used for Ajax's body in *Il.* 13.830, is commonly interpreted as 'delicate flesh',<sup>34</sup> 'desired', or 'lily-like', but these translations ignore one specific nuance which will be discussed below.

*Chrôs* is said to be neither of stone nor of iron. Because it is human and easy to penetrate it is not insensitive (*Il.* 4.510).<sup>35</sup> It is with the cutting gesture sanctioned by the war, *temnein* (a verb from which the noun *anatomê*, 'dissection', is derived)<sup>36</sup> that these qualities of the body are discovered. Spears are *tamesichroa*, 'cutting the flesh' (*Il.* 4.511, 13.340, 23.803). In cutting the victim they violently violate the bodily boundaries (in order to overcome a military crisis).<sup>37</sup> Spears are eager to sate themselves with *chrôs* (*Il.* 11.574, 15.317),<sup>38</sup> like the warriors desire to slash the bodies of one another with pitiless bronze (*Il.* 13.501, 16.761).<sup>39</sup> Spears in parallel with cruel pains penetrate, or *go through* the human body (*Il.* 11.398, 20.100),<sup>40</sup> dent the flesh (*Il.* 8.298, 15.315).<sup>41</sup> The heroic body is disrupted and deformed

<sup>32</sup> Another epithet, *ίμερόεις*, charming, desired, is used for the divine body of Hera in *Il.* 14.170.

<sup>33</sup> In Homer Achilles is not yet represented as 'imperfectly invulnerable'. This is probably the product of a post-Homeric culture. It would be more convenient to describe the Homeric Achilles as perfectly vulnerable. For the hero's 'imperfect invulnerability' see Burgess J., "Achilles' Heel: The Death of Achilles in Ancient Myth", *Classical Antiquity* 14, 2 (1995) 217–244.

<sup>34</sup> Segal C., *The Theme of the Mutilation of the Corpse in the Iliad* (Leiden: 1971) 9.

<sup>35</sup> 'οὐ σφι λίθος χρώς οὐδὲ σίδηρος'. *Scholia Graeca in Homeri Iliadem (scholia vetera) bT ad 4.510* 'πρὸς ἀνθρώπους καὶ τρωτοὺς ἡ μάχη'. *Scholia in Iliadem (scholia recentiora Theodori Meliteniotis) (e cod. Genevensi gr. 44)* on the λίθος: τὸ σῶμα ἀναίσθητος'.

<sup>36</sup> Staden H. von, "The Discovery of the Body: Human Dissection and its Cultural Contexts in Ancient Greece", *Yale Journal of Biology and Medicine* 65 (1992) 223–241, 230.

<sup>37</sup> Staden, "The Discovery of the Body" 230.

<sup>38</sup> 'λιλαϊόμενα χροὸς ἄσαι'.

<sup>39</sup> 'ἔεντ' ἀλλήλων ταμέειν χροά νηλεῖ χαλκῶ'.

<sup>40</sup> 'πρὶν χροὸς ἀνδρομέοιο διελθήμεν; ὁδύνη δὲ διὰ χροὸς ἦλθ' ἀλεγεινῇ'.

<sup>41</sup> 'πάντες δ' ἐν χροῖ πῆχθεν'.

equally and in the same way (as the use of identical epic formulas show) by weapons, natural decay, and strong emotions.<sup>42</sup> In numerous instances in both the *Iliad* and the *Odyssey*, *chrôs* and other bodily parts are tortured by grief, terror, and pain. Although this topic has already been thoroughly investigated, researchers deal mainly with the ‘organs of consciousness’: *thumos* (breath, life), *phrenes* (diaphragm, lungs), *prapides* (diaphragm, heart), *kêr* (heart), *kradiê* (heart), etc. Much less attention is paid to the body itself. Meanwhile, the Homeric texts are rich enough to be analysed with a view towards emotional intrusions and their effect not only upon the internal ‘organs’ but on the whole body as well.

### *The liquid body*

Some difficult passages in the *Iliad* and the *Odyssey* touch upon the corporeal transformations produced by emotions on the body. In particular, the manifestation of the ‘effect of liquefaction’ that results is sometimes found in Homer. When Penelope is listening to the story the stranger tells her about Odysseus, she pours out tears and her *body melted* (*Od.* 19.204).<sup>43</sup> Somewhat later, Odysseus the stranger, whom Calypso asked earlier not to *waste his aiôn* (*Od.* 5.160–161),<sup>44</sup> persuades Penelope not to *waste away* her beautiful *chroa*, not to *melt her thumos* weeping so much (*Od.* 19.263–264).<sup>45</sup> *Têkô* is a verb that expresses the corporeal changes of a hero overwhelmed with grief and suffering. In *Od.* 2.376, Telemachus fears that his mother may hurt or dry out (*iaptê*) her beautiful *chroa* crying for him. So Odysseus at Alcinous’ palace is melting while he listens to the song of Demodocus about the Trojan War (*Od.* 8.521–522).<sup>46</sup> He sheds excessive tears from beneath his brows, and his cheeks are wasted away in grief (*achei phthinuthousi*), just like those of a woman mourning near her dying husband (8.530–531). *Têkô*, *iaptô*, *phthinuthô* describe one and the same process in which the whole body is involved. It is the liquefaction and desiccation that are the result of bodily liquid loss. The body *têketai* – attenuates, decays, liquifies – together

<sup>42</sup> For instance, the body of Laertes, in grief for his son, has dried out, and withered around the bones (*Od.* 16.145 ‘φθινύθει ἄμφ’ ὀστεόφιν χρώς’). The text correlates with the sepsis of corpses of the Sirens’ victims in *Od.* 12.45–46 ‘πολλὺς δ’ ἄμφ’ ὀστεόφιν θίς | ἀνδρῶν πυθομένων, περὶ δὲ ῥίνοι μινύθουσιν’.

<sup>43</sup> ‘ῥέε δάκρυα, τήκετο δὲ χρώς’.

<sup>44</sup> ‘μηδὲ τοι αἰῶν | φθινέτο’.

<sup>45</sup> ‘μηκέτι νῦν χροά καλὸν ἐναίρεο μηδὲ τι θυμὸν | τήκε πόσιν γοώσῃ’.

<sup>46</sup> ‘Ὀδυσσεύς/τήκετο, δάκρυ δ’ ἔδευεν ὑπὸ βλεφάροισι παρειάς’.

with its *thumos* when a hero is seized with grief and pain (*achos*, *ponos*, *goos*). Pain may attack the *phrenes* too, together with a warrior's flesh.<sup>47</sup> Apart from the *thumos* and *phrenes*, the *êtor* (heart) can be 'consumed', 'wasted away' as well (*Od.* 19.136).<sup>48</sup> As Eustathius of Thessalonica explains, when grieving inside, beautiful *chrôs* is affected as well.<sup>49</sup> The whole hero softens and melts, liquifies into water.

Tears and grief may take the place of any food for the Homeric heroes, as they themselves become a source of nutrition. As Dominique Arnould explains,

Non seulement les yeux, les joues, la peau semblent fondre dans la chaleur des larmes – image liquide parallèle à δάκρυα θερμὰ χέων et au thème de la source des larmes [...] – mais encore le héros jeûne, nourrit ses larmes de sa propre substance, et se rassasie lui-même de larmes.<sup>50</sup>

*Cheô* is once applied to Priam's *noos* (mind) which spilled, *chutô*, in awful fear (*Il.* 24.358). Its flow, similar to that of tears and moisture, can be also associated with the flow of death (*Il.* 13.544 = 16.414, 580) and darkness (*Il.* 5.696 = 16.344 = 20.421, *Od.* 22.88) experienced by the Homeric heroes.

The texture of internal 'organs', 'organs of consciousness', undergoes changes in cases where the verb *iainein* introduces an emotion which is not named in the epic but is identified as pleasure or joy. Although *iainô* has less to do with liquefaction than *têkô* and *phthinô*, there is allusion to it when the verb is applied to water and wax (*Od.* 10.359, 12.175). Its more evident meaning is, according to van Brock, 'échauffer, ammolir par la chaleur', 'apaiser, conforter, contenter'.<sup>51</sup> *Thumos*, *êtor*, *kêr*, *phrenes* become warm and soft, *iainein* (in joy, but the word 'joy' is not used).<sup>52</sup>

<sup>47</sup> Cf. *Od.* 8.541 'ἄχος φρένας ἀμφιβέβηκεν and 8.530 ἄχεϊ φθινύθουσι παρειαί'.

<sup>48</sup> 'κατατήκομαι ἦτορ'.

<sup>49</sup> Eustathius Thessalonicensis, *Commentarii ad Homeri Odysseam* 1.104.8 ad 2.376 'ὁ πάσχοντος ἐντὸς, ἰάπτεται καὶ ὁ καλὸς χρόυς'.

<sup>50</sup> Arnould D., "Τῆκεν dans la peinture des larmes et du deuil chez Homère et les tragiques", *Revue de philologie, de littérature et d'histoire anciennes* 60, 2 (1986) 267–274, 269. The article offers an analysis of the effect of liquefaction/dessication that emotions have upon the heroes in Homer and in Greek tragedy. Arnould also finds a number of parallels between Homer, the tragic poets, and the Hippocratics demonstrating the similarities in perception and conceptualisation of the 'physiology' of emotional life. For a more detailed study of pain and suffering in Homer, see Mawet F., *Recherches sur les oppositions fonctionnelles dans le vocabulaire homérique de la douleur (autour de πῆμα-ἄλγος)* (Brussels: 1979).

<sup>51</sup> Brock N. van, *Recherches sur le vocabulaire médical du grec ancien. Soins et guérison* (Paris: 1961) 255.

<sup>52</sup> ἰαίνειν: *Il.* 23.598, 600, 24.321, 24.119 = 147 = 176 = 196, *Od.* 15.165, 379, 23.47; *Od.* 4.840; *Od.* 22.59; *Il.* 19.174, respectively.

There is one case where *lainomai* corresponds not to a particular place in the body but to the 'whole' person, who softens and becomes warm in joy (*Od.* 19.536),<sup>53</sup> which parallels the melting of the 'whole' Odysseus in his sufferings in *Od.* 8.521–522.<sup>54</sup>

When both flesh (skin) and internal 'organs' are liquified, they constitute a kind of bodily unity where there is no evident difference between the inner and outer body, or the depth and surface of the body. They are all melted together simultaneously. With the fluid bodily texture, any distinction between the exterior and the interior of the body is eliminated, which offers an image of a body-flux, of a one-dimensional body.

It seems to me likely that the Pythagorean and Platonic allegorical interpretations of Homer derive from this image of a liquid body. However, their reading of Homer is infused with morality, and their body figures in opposition to the soul. Félix Buffière offers some Platonic expressions on the liquid body, such as: 'Or notre corps est "matière". De plus c'est une matière tout imprégnée de liquide (*hugron*), comme les îles baignées par la mer'.<sup>55</sup>

In the Hippocratic texts we find the conceptualisation, as Arnould shows, of Homeric intuitions about the physiological and psychological processes in the human body, particularly their effect of liquefaction upon the body.

Homeric texts imply the idea of fluidity of the heroic body, an idea articulated by the epithets that describe *chrôs*, such as *leirioeis* and *terên*. *Leirioeis*, used not only for the flesh in Homer and in Greek poetry, is traditionally understood as 'lily-like'. There are lily-like voices (Homer), lily-like flowers from the sea (Pindar), and lily-like eyes (Bacchylides).<sup>56</sup> Rory Egan's analysis of the epithet's semantics demonstrates its association with 'moist', 'liquidity', 'dew'.<sup>57</sup> The Greeks may say 'moist voice' or 'liquid

<sup>53</sup> 'καί τέ σφιν λαινομαι εισορώσα'.

<sup>54</sup> These observations demonstrate once again that the archaic Greeks 'did not construct any definitive barrier between physical suffering and intense emotional suffering', Harris W., *Restraining Rage. The Ideology of Anger Control in Classical Antiquity* (Cambridge, MA: 2001) 340.

<sup>55</sup> Buffière F., *Les mythes d'Homère et la pensée grecque* (Paris: 1956) 461. It is the isle of Calypso that illustrates the image of liquid body which 'imprisons' the soul of wise Odysseus.

<sup>56</sup> Egan R.B., "Λειριόεις κτλ. in Homer and Elsewhere", *Glotta* 63 (1985) 14–24, 19–20.

<sup>57</sup> As *leirioeis* and *leirios* are also used in Greek literature to describe the cicada's voice and behaviour, Egan evokes some curious facts pertinent to my study of a 'body without skin' and a 'liquid body' in Homer: 'These insects congregate on trees from which they draw liquid in vast quantities, allowing some of it to ooze from the holes which they



voice'; the metaphor is typically Homeric, although to us it may sound unusual. The metaphor makes the invisible voice tangible. The song of cicadas is a perfect image of palpability and density of the invisible matter. Why is human flesh 'lily-like' and how is it related to liquidity? The case of Ajax's *leirioenta chroa* threatened by Hector's spear in *Il.* 13.830 needs some explanation:

[...] we can make satisfactory sense of 'lily-like' or 'white' in this case, although the context does not dictate that sense here either. Could the skin (or flesh) of Ajax, then, have been called "moist" or "fluid" or "dewy" by Hector? There are any number of imaginable reasons for answering that question in the affirmative – the reference could be to perspiration, for example or (proleptically) to the blood which the spear will draw, or to the moistness of the flesh which the spear will 'bite' [...].<sup>58</sup>

Moreover, from Vivante's point of view, the lily and its imagery, unlike other flowers, are related not to a colour, but to density, softness, and depth or thickness. The beauty of the Homeric hero's body has little to do with elegance: 'in order to appreciate *leirioeis*, we must give up the notion of anything refined or exquisite. This beauty is of a different kind. It is hardly a matter of taste. It consists in a vital fullness'<sup>59</sup> and moistness.

In the Homeric poems the softness of *chrôs* is constantly underlined. Another epithet, *terên*, also merits attention. It is used for 'wounded, mangled, threatened'<sup>60</sup> flesh. *Terena chroa*, for Eustathius, 'concerns the whole flesh from its surface to the bones. For the latter are not soft (moist) or delicate. Thus *chroûs* as well as *chrôs* is apparently a visible (open) [part] of flesh in the human'.<sup>61</sup> The etymology of *terên* associates the epithet with the moistness of *leirioeis*, and with the fullness and bloom of *thaleros*

---

have punctured in the plant. They almost immediately excrete most of the ingested juice in similar quantities after having altered its physical and chemical properties somewhat. Observers speak of a fine mist descending from the trees and of a sweet viscous substance dampening the leaves and branches of the tree and the ground below. The substance excreted by cicada [...] is known as "honey-dew", a poetic term which happens to be the normal scientific one as well' (18–19).

<sup>58</sup> Egan, "Λειριόεις κτλ." 22.

<sup>59</sup> Vivante P., *The Epithets in Homer. A Study in Poetic Values* (New Haven-London: 1982) 118.

<sup>60</sup> Vivante, *The Epithets in Homer* 117.

<sup>61</sup> Eustathius, *Commentarii ad Homeri Iliadem* 1.738.26–29 ad 4.237 'Τέρενα δὲ χροά τὴν ὅλην σάρκα λέγει ὡς ἐκ μέρους τοῦ προφανομένου ἐξ ἐπιπολῆς πρὸς διαστολὴν τῶν ὀστέων. ἐκεῖνα γὰρ οὐ τέρενα ἦτοι ἀπαλά. ὥσπερ δὲ ὁ χροῦς, οὕτω καὶ ὁ χρώς τὸ προφανόμενον δηλοῖ τῆς κατ' ἀνθρώπον σαρκός'. There is a surprising contrast between the delicacy of the flesh and the ability of the wounded heroes to carry heavy spears (which could weigh up to 8 lbs) in their fragile bodies.

used for tears. *Terên* as synonymous to *thalerós* refers to tears in *Il.* 3.142, 16.11, 19.323; *Od.* 16.332. It is applied also to leaves being crushed. Vivante, wondering what tears, leaves and flesh hold in common, supposes it to be their softness and tender texture, with an explicit tinge of fluidity: '[...] what the epithet brings out is the thing itself – the effluence, the lymphous drop'.<sup>62</sup> The moisture which *terên* contains makes plants smooth; a vital liquid indicated by *terên* makes the flesh smooth and firm as well.

Blood, tears, pain, heat of the sun, and sea salt are the 'agents' of bodily transformations which result in the loss of vital liquid, a loss that threatens life. For Richard Onians, this fluid is *aiôn* that oozes with tears from the body.<sup>63</sup> Interestingly, *aiôn* is never mentioned in the epic depictions of the very moment of death, although it is closely related to it.<sup>64</sup>

The Homeric vocabulary generates a perception (not to say *vision*) of a body that is distinctly tactile, even liquid, open to physical forces as well as 'emotions'.

Apart from the verbs discussed previously revealing the liquidity of the bodily texture, there is a wide range of predicates which condense the idea of *chrôs*' fragility, its openness, its potential for being easily pierced/consumed (either by dogs and spears, pain, grief, or destroyed by sepsis). By and large, these are the verbs: *amenai*, to feed, satiate (*Il.* 11.574, 15.317, 21.70, 168); *anaspaô*, to pull, draw out (*Il.* 13.574); *antitoreô*, to stab, drive through (*Il.* 5.337); *daptô*, to lacerate (*Il.* 5.858, 13.831, 21.398); *dierchomai*, to pass through, pierce (*Il.* 20.100); *edô*, to consume, torture, destroy (*Il.* 4.237); *eirgô*, to defend, restrain; detach, cut off (*Il.* 11.437); *harpazô*, to seize, grasp (*Il.* 16.814); *helkô*, to draw, pull out (*Il.* 11.457); *epaurein*, to touch (*Il.* 11.573, 13.649, 15.316); *epigraphô*, to scratch, touch slightly (*Il.* 4.139, 13.553); *karpô*, to dry out (*Od.* 13.398, 430); *komizô*, to receive (*Il.* 14.456, 22.286); *melainô*, to darken, blacken (*Il.* 05.354, cf. *Od.* 16.175); *oideô*, to swell (*Od.* 5.455); *outazô*, to wound, hit (*Il.* 12.427); *pêgnumi*, to jab (*Il.* 8.298, 15.315); *rêgnumi*, to pierce, break, claw (*Il.* 23.673); *sêpô*, to putrefy (*Il.* 19.27, 24.414); *skellô*, to dry out (*Il.* 23.191); *temno*, to hit, wound, cleave,

<sup>62</sup> Vivante, *The Epithets in Homer* 117.

<sup>63</sup> Onians R.B., *The Origins of European Thought: About the Body, the Mind, the Soul, the World, Time, and Fate* (Cambridge: 1954) 203 'It is this liquid from the eyes which Homer calls αἶον and three times says "wastes" or "flows down" as husband or wife weeps, yearning for the other'.

<sup>64</sup> Bremmer J., *The Early Greek Concept of the Soul* (Princeton: 1983) 74 'because death is expressed as the departure of the *aiôn* (v.685; 7.224) or the deprivation of the *aiôn* (xxii.58). Achilles is afraid that the maggots will defile the dead body of Patroclus "for the *aiôn* has been slain out" (xix.27)'.

sever (*Il.* 13.501, 16.761); *trepomai*, to change (colour), turn (*Il.* 13.279, 284, 17.733, *Od.* 21.412–413); *ôchraô*, to become pale (*Od.* 11.529, cf. *Il.* 3.35).

Although verbs for the 'protection' of the body are present in the Homeric texts as well, in epic descriptions of the body (*chrôs*), connotations of deformation (of any kind) and destruction prevail. Penetration is thus constitutive for the heroic body as it stays in permanent physical mixture with objects. It is through constant deformation and penetration that birth is given to *chrôs*, a matter that curiously combines its openness to and distinction from external influences.

### *Anointing. To fit the form*

It is important that *chrôs* be washed and anointed 'richly with oil', especially when a hero sheds abundant *terena dakrua*: there is a danger hidden in the excessive loss of the bodily fluid that is corporeal vitality. Water and oil have to return vital moistness to the body and keep it firm and intact (*empedos*). In Homer, the hygienic procedures of washing and anointing are quite frequent. There are many instances when heroes express their desire to wash themselves or advise others to be washed and anointed. The formulas *chroa kalon aleipsamenê*, *lip' aleipsen*, *lip' elaiô*, used variously throughout the *Iliad* and abundantly in the *Odyssey*, indicate the importance of this everyday cosmetic practice, essential both for women and men, mortals and immortals.<sup>65</sup> *Aleiphô*, *chriô*, used to describe the Homeric heroes' hygiene, are those actions that help to reanimate the body, because *elaion* and *aloiphê* infused into the body impregnate it with vital substance.<sup>66</sup>

The care of the body is applicable to divine bodies as well. Observing how Hera, for instance, washes, anoints, and dresses herself in *Il.* 14, one would not notice any crucial difference between the mortal and the immortal bodies, particularly in the 'texture' of their flesh. Homer sounds minimalistic enough in his representations of the divine bodies.<sup>67</sup>

<sup>65</sup> The bath of Odysseus at Alcinous *Od.* 6.219–220; at Circe's palace, 10.450; at home, 19.320, 505; Penelope and the treatment of her face: 18.172, 179, 192–193 where a divine (Aphrodite's) unguent is used; Hera's perfumed oil, *Il.* 14.170–172, etc.

<sup>66</sup> Onians suggests that Aeschylus could use the verb *χρῶ* in the sense of 'penetrate, pierce', Onians, *The Origins* 211.

<sup>67</sup> Kirk is aware of the 'Homeric tendency to minimise many of the more carnal aspects of the gods'. See Kirk G.S. *The Iliad. A Commentary* (Cambridge: 1990) 96.

Excluding their huge sizes, the gods seem to be like humans, especially when they are wounded and suffer from pain, like Ares or Aphrodite.

However, a remark on Ares, whose case is extraordinary, is important here. Eustathius offers an extensive comment on *talaurhinos* Ares' skin:

For the *rhinos* of the other warriors is not firm, nor tough, nor impenetrable, but obviously soft and delicate. According to what the poet says, the *chrôs* of the men who struggle is not stone, nor iron, if they cover themselves with iron; but the *rhinos* of this warrior, of Ares [...] is firm, even the strongest, as if he were covered with *derma* [...] *Talaurhinos*, for the ancients, is [used] instead of brave, powerful.<sup>68</sup>

The human *chrôs* and that of the gods are equally vulnerable, *trôtos*.<sup>69</sup> In his *Protreptic*, Clement of Alexandria paraphrases the Homeric expression about Achilles, *trôtos chrôs* [...] *thnêton de he phas' anthrôpoi*, in *Il.* 21.568–569, substituting *trôtos* for *thnêtos*, mortal, and applying it to the gods of the Greeks: '[...] it remains for me to bring before you those amatory and sensuous deities of yours, as in every respect having human feelings. | "For theirs was a mortal body."'<sup>70</sup> If it is possible to wound a god, if the divine flesh may be pierced and the penetration is painful, therefore, the gods are mortal.

Besides the living divine and human bodies, there are the fallen heroes whose bodies require care before they are burnt in the funeral fire. When the dead Sarpedon, Patroclus, and Hector are washed and anointed, their bodies remain intact, untouched by flies, worms and dogs, by the sun withering the flesh, by any decay, harm and outrage.<sup>71</sup> Thetis treats Patroclus' dead body so that it might be 'sound always, or better even than it is'.<sup>72</sup> Apollo keeps the body of Hector away from every violation, *pasan aeikeiê*, and covers him with the golden aegis in order that Achilles may not tear his body while dragging him. The dead heroes seem to be much stronger

<sup>68</sup> Eustathius, *Commentarii ad Homeri Iliadem* 2.74.13–75.15 ad 5.289 'τοῖς μὲν γὰρ ἄλλοις πολεμισταῖς ὁ ῥίνος οὐ τάλας ἐστίν, ἦτοι καρτερικός, οὐδὲ ἀτειρής, ἀλλὰ δηλονότι τέρην καὶ ἀπαλός. κατὰ γὰρ τὸν ποιητὴν εἰπεῖν τοῖς μὲν μαχομένοις ἀνδράσιν ὁ χρῶς οὐ λίθος οὐδὲ σίδηρος, εἰ καὶ σιδήρῳ καταφράττονται, τούτῳ δὲ τῷ πολεμιστῇ Ἄρει [...] τάλας ἐστίν ὁ ῥίνος, ἥγουν στερρότατόν ἐστι τὸ ἐπιπολάζον αὐτοῦ καὶ ὡς οἶον δέρμα ἐν ἐπιφανείᾳ προκείμενον [...] Ἔστι δὲ τὸ ταλαύριος κατὰ τοὺς παλαιούς ἀντὶ τοῦ εὐτολμος, ἰσχυρός'.

<sup>69</sup> Cf. Aphrodite and Ares wounded by Diomedes: *Il.* 5.335–346 and 5.855–861.

<sup>70</sup> Clemens Alexandrinus, *Protrepticus* 2.36.1 'Τούτοις οὖν εἰκότως ἔπεται τοὺς ἔρωτικους ὑμῶν καὶ παθητικὸς τούτους θεοὺς ἀνθρωποπαθεῖς ἐκ παντὸς εἰσάγειν τρόπον. "Καὶ γὰρ θην κείνους θνητὸς χρῶς"' (Translated into English by Schaff Ph.).

<sup>71</sup> Sarpedon *Il.* 16.678–680; Patroclus 18.344–351, 19.33, 38–39; Hector 23.186–191, 24.19–21, 414.

<sup>72</sup> *Il.* 19.33 (Translated by Murray A.T.).

and firmer than during their brief lives.<sup>73</sup> *Chrôs empedos* is, thus, a state of body in which flesh does not decay, *oude* [...] *chrôs sêpetai* (*Il.* 24.414). It is *sôma aphthoron*<sup>74</sup> opposed to the living *trôtos chrôs*. Here is a curious inversion: *empedos* is applied to the corpses of the fallen heroes<sup>75</sup> whom we thus may call immortal mortals, while *trôtos* correlates with the living bodies not only of mortals, but of immortals as well, and in this case the gods are represented as mortal immortals.

If one searches for a hypothetically similar bodily experience in cultures beyond Homer, it is possible to juxtapose distant discourses and compare Homeric *chrôs* with, for instance, a 'schizophrenic' experience of the body as described by the Russian phenomenologist Valery Podoroga:

In the schizophrenic experience of the body between what we have come to consider the Outer, that is, what is located outside of us, beyond the borders of our body [...] and that which we have come to consider the Inner, *only* my body, experience, passion [...] which surrounds our 'I' [...] there is no intermediate membrane; more exactly, the skin surface which separates the Inner from the Outer and preserves their tense unity is absent. Perhaps the skin surface exists [...] however, it does not separate the bodies, but, on the contrary, enhances their physical interfusion and mutual penetration.<sup>76</sup>

Even if one looks back in time towards the Middle Ages and early modern Europe, one will find the same amorphous and vague bodily boundaries, including interpenetrations (and fear of interpenetrations) with the environment. Galenism had a strong influence in Europe throughout this period, not only on medical thought, but also on the popular mentality. It probably played a particular role in the elaboration of an image of the 'infiltrated' body. This is the body that consists of porous and highly penetrable envelopes, the permeability of which results in a low resistive capacity of the human being in face of danger (such as plague or other illnesses and harmful influences).<sup>77</sup>

<sup>73</sup> An important exception is the scene of the mutilation of Hector's dead body by the Achaeans. While the Achaeans admire his marvellous figure and appearance, they pierce, one after another, his body with spears, and at this point become astonished when they reveal that Hector's body is much softer to the touch (*Il.* 22.370–374).

<sup>74</sup> *Scholia D in Homeri Iliadem ad* 19.39.

<sup>75</sup> The word ἀσκηθής has a similar meaning, used for the living heroes in the major sense of coming back home 'safe and sound': *Il.* 10.212, 16.247, *Od.* 5.26 = 144 = 168, 9.79, 11.535, 14.255. For a brief discussion of the word see Bowra C.M., "Homeric Words in Arcadian Inscriptions", *Classical Quarterly* 20 (1926) 168–176, 171.

<sup>76</sup> Подорога В., *Феноменология тела. Введение в философскую антропологию* (Moscow: 1995) 28.

<sup>77</sup> The subject is investigated in particular by Vigarello G., *Le propre et le sale, l'hygiène du corps depuis le Moyen Age* (Paris: 1985).

Such a close, almost anatomical, study of the Homeric body (*chrôs*) makes it possible to assume that Homer does not have a developed concept of human skin. *Chrôs* is usually interpreted as skin, flesh, body, and colour. But, as most occurrences show, skin as an anatomical part of a hero is initially absent as long as *derma* and *rhinos* are associated mostly with the animal hide which has its quality of detachability from the rest of the body and plays the role of a barrier and protection for the living Homeric bodies. The epic body represented by *chrôs* appears in the texts at the very moment its life is at stake. In the *Iliad* it is the context of war: in the *Odyssey* it is mainly psychological sufferings described as physical processes. Being constantly subject to any imaginable means of deformation and destruction, physical and psychic (both hardly distinguishable one from another), *chrôs* constitutes a particular concept of Homeric body, a 'body without skin' with depth and surface fused. It is flesh trembling in fear together with the 'organs of consciousness', a liquid mass flowing together with *thumos* in streams of tears of grief and longing; it is a penetrated, chopped, devoured-by-war slab of meat. In contrast, the destructive powers may be neutralised and the disintegrated bodies restored 'richly with oil', in life or in death. This is no argument against my hypothesis, but rather additional proof for it, for anointing is penetration and deformation of the body too. The Homeric poems explicate the condition where the epic body finds itself and which by no means suggests that heroes lack their 'self'.<sup>78</sup> This is the condition of a mixture, of a mutual penetration of objects and other bodies.

---

<sup>78</sup> The problem of mixture of bodies, whether it is absolute or partial, would go on to be discussed and resolved by the ancient Greek philosophers in different ways (e.g. Stoics and Peripatetics).

*Selective bibliography*

- ARNOULD D., "Τῆκειν dans la peinture des larmes et du deuil chez Homère et les tragiques", *Revue de philologie, de littérature et d'histoire anciennes* 60, 2 (1986) 267–274.
- BOLENS G., "Homeric Joints and the Marrow in Plato's Timaeus: Two Logics of the Body", *Multilingua* 18, 2/3 (1999) 149–157.
- , *La logique du corps articulaire. Les articulations du corps humain dans la littérature occidentale* (Rennes: 2000).
- , "The Limits of Textuality: Mobility and Fire Production in Homer and Beowulf", *Oral Tradition* 16, 1 (2001) 107–128.
- BOWRA C.M., *Greek Lyric Poetry. From Alcman to Simonides* (Oxford: 1961).
- , "Homeric Words in Arcadian Inscriptions", *Classical Quarterly* 20 (1926) 168–176.
- BREMMER J., *The Early Greek Concept of the Soul* (Princeton: 1983).
- BROCK N. VAN, *Recherches sur le vocabulaire médical du grec ancien. Soins et guérison* (Paris: 1961).
- BUFFIERE F., *Les mythes d'Homère et la pensée grecque* (Paris: 1956).
- BURGESS J., "Achilles' Heel: The Death of Achilles in Ancient Myth", *Classical Antiquity* 14, 2 (1995) 217–244.
- CLARKE M., *Flesh and Spirit in the Songs of Homer. A Study of Words and Myths* (Oxford: 2000).
- CLEMENS OF ALEXANDRIA, *Protrepticus*: ed. Mondésert C. (1949), *Le protreptique*, Paris.
- EGAN R.B., "Λειριόεις κτλ. in Homer and Elsewhere", *Glotta* 63 (1985) 14–24.
- Eustathii Commentarii ad Homeri Iliadem pertinentes*, vols. 1–4: ed. Valk M. van der (1971–1987), Leiden.
- , *Commentarii ad Homeri Odysseam*, 2 vols. in 1: ed. Stallbaum G. (1825–1826), Leipzig (repr. Hildesheim: 1970).
- GALEN, *Opera omnia*: ed. Kühn C.G., 20 vols. (Leipzig: 1821–1833).
- HARRIS W., *Restraining Rage. The Ideology of Anger Control in Classical Antiquity* (Cambridge, MA: 2001).
- HOMER, *Ilias*: ed. Allen T.W. (1931), Oxford.
- , tr. Murray A.T. (1999), *Iliad*, Loeb, Cambridge, Mass.
- , *Odyssea*: ed. Mühl P. von der (1962), Basel.
- , tr. Murray A.T. (1995), *Odyssey*, Loeb, Cambridge, Mass.
- KIRK G.S., *The Iliad. A Commentary. Volume II. Books 5–8* (Cambridge: 1990).
- LORAUX N., *The Experiences of Tiresias. The Feminine and the Greek Man* (Princeton: 1995).
- MAWET F., *Recherches sur les oppositions fonctionnelles dans le vocabulaire homérique de la douleur (autour de πῆμα-ἄλγος)* (Brussels: 1979).
- NAGY G., *Greek Mythology and Poetics* (Ithaca-London: 1990).
- , *Homeric Questions* (Austin: 1996).
- ONIAN R.B., *The Origins of European Thought: About the Body, the Mind, the Soul, the World, Time, and Fate* (Cambridge: 1954).
- PIGEAUD J., "La peau comme frontière", *Micrologus. La pelle umana. The Human Skin* 13 (2005) 23–53.
- ПОДРОГА В., *Феноменология тела. Введение в философскую антропологию* (Moscow: 1995) = PODOROGA V., *Phenomenology of the Body. Introduction into Philosophical Anthropology* (Moscow: 1995).
- PSEUDO-PLUTARCH, *Placita philosophorum*: ed. Mau J. (1971), *Plutarchi Moralia*, Leipzig [vol. 5.2.1].
- RENEHAN R., "The Meaning of ΣΩΜΑ in Homer: A Study in Methodology", *California Studies in Classical Antiquity* 12 (1979) 269–282.
- Scholia D in Iliadem*, ed. Thiel H. van (Cologne: 2000).
- Scholia Graeca in Homeri Iliadem (scholia vetera)*: ed. Erbse H. (1969–1988), Berlin, [vols. 1–5, 7].



- Scholia Graeca in Homeri Odysseam*: ed. Dindorf W. (1855), Oxford (repr. Amsterdam: 1962), 2 vols.
- Scholia in Iliadem (scholia recentiora Theodori Meliteniotis) (e cod. Genevensi gr. 44)*: ed. Nicole J. (1891), *Les scolies genevoises de l'Iliade*, Geneva (repr. Hildesheim: 1966) [vol. 2].
- SEGAL Ch., *The Theme of the Mutilation of the Corpse in the Iliad* (Leiden: 1971).
- SNELL B., *The Discovery of the Mind in Greek Philosophy and Literature* (New York: 1982).
- STADEN H. VON, "The Discovery of the Body: Human Dissection and its Cultural Contexts in Ancient Greece", *Yale Journal of Biology and Medicine* 65 (1992) 223–241.
- , "The Mind and Skin of Heracles: Heroic Diseases" in Gourevitch D. (ed.), *Maladie et maladies, histoire et conceptualisation. Mélanges en l'honneur de Mirko Grmek* (Geneva: 1992) 131–150.
- VERNANT J.-P., *L'Individu, la mort, l'amour. Soi-même et l'autre en Grèce ancienne* (Paris: 1989).
- , *Mortals and Immortals. Collected Essays* (Princeton-New Jersey: 1991).
- VIGARELLO G., *Le propre et le sale, l'hygiène du corps depuis le Moyen Age* (Paris: 1985).
- VIVANTE P., *The Epithets in Homer. A Study in Poetic Values* (New Haven-London: 1982).

## SWEAT. LEARNED CONCEPTS AND POPULAR PERCEPTIONS, 1500–1800

Michael Stolberg

### *Summary*

This paper analyses the perception and interpretation of sweat and insensible transpiration in early modern learned medicine and medical lay culture. Based on Galenic physiology, sweat was thought to excrete superfluous serum, harmful impurities and sometimes also fat, chyle or blood. Since sweat was closely associated with pollution and stench, its timely elimination seemed crucial, and physicians and lay-people alike ranked the suppression of sweating among the major causes of disease. Sudorifics and sweat baths were widely used in prophylaxis and therapy. Excessive sweat carried the risk of losing too much vital matter, however. The copious sweat of consumptives, in particular, was taken as evidence that their bodily substance was melting away. Constantly confirmed by the seemingly naturally given, self-evident but inevitably culturally-framed experience of the body in health and disease, and thus deeply rooted in the contemporary bodily habitus, many of these notions and images remained alive in spite of new anatomical findings and profound changes in medical theory.

Sweating ranks among the most basic, elementary bodily experiences. Yet sweat is also heavily fraught with culturally-embedded images and notions. For many people in western societies, sweaty armpits are a major cause of embarrassment and can, at times, even seriously affect social interaction. Antiperspirants and deodorants have developed into a multi-billion dollar market. Saunas and steam baths are hailed as a powerful means to 'detoxify' the body. Far more than one would expect from a seemingly innocuous, bland, watery fluid, sweat is associated with shame and embarrassment, with pollution and stench, but also with purification, sexual attraction and masculinity.

Surprisingly, historians of medicine and the body have so far paid hardly any attention at all to sweat.<sup>1</sup> The following survey of early modern

---

<sup>1</sup> For the only extant, and somewhat dated, historical survey of medical theories on sweating see Renbourn E.T., "The Natural History of Insensible Perspiration: A Forgotten Doctrine of Health and Disease", *Medical History* 4 (1960) 135–152, and, primarily on the topic of the sweat rash, idem, "The History of Sweat and the Sweat Rash from Earliest Times to the End of the 18th Century", *Journal of the History of Medicine and Allied Sciences* 14 (1959) 202–227.

meanings of sweating and transpiration and the theories and practices surrounding them is thus a first attempt to chart still largely unexplored territory. My analysis will draw, above all, on learned writing. I will supplement this material, however, as much as possible with evidence from patient letters, autobiographies and ethnographic accounts which give a better grasp of the meanings of sweat in the medical culture and daily lives of ordinary people. Inevitably, covering a period stretching over three centuries with hardly any groundwork by other scholars to build upon requires a certain degree of bold generalisation. Thus I will not be able to analyse in any depth the subtle differences in the ways individual authors understood sweat and, although I will mention new anatomical and histological findings and new medical theories such as iatrochemistry, Stahlianism and vitalism, I will not make a systematic attempt to trace their impact on different authors or their respective views on sweating. This approach seems justified not only by the lack of extant research but also by the fact that the medical understanding and the lay experience of sweating emerge as remarkably stable throughout the period under consideration. And, it is hoped, this overview can entice other scholars to look in greater detail at individual authors, theories, periods or issues in this field.

### *The learned tradition*

Sweat played a considerable, but not particularly prominent, place in early modern medical writing. It was the topic of several dozens of medical dissertations. Medical textbooks usually mentioned sweating, at least briefly. Collections of medical observations, a very popular genre at the time, contain stories of patients with more or less extraordinary types of sweat.

Early modern medical writing on sweat was based above all on Galen. Galen, and early modern physicians with him, described sweating as an excretion of thin, 'serous' humours. Somewhat surprisingly from a modern perspective, sweat was closely related to urine.<sup>2</sup> Because, according to Galen, both sweat and urine ultimately originated from the same matter, both contained a certain amount of bile<sup>3</sup> and both were, in their natural

---

<sup>2</sup> Musitano Carlo, *Opera omnia, seu trutina medica, chirurgica, pharmaceutico-chymica* (Geneva, Cramer and Perachon: 1716), vol. II, 392; Slevogt Johannes Adrian, *De sudoribus*. Subj. J.G. Pilling (Jena, Werther: 1697) prooemium.

<sup>3</sup> Galenus, *De simplicium medicamentorum temperamentis ac facultatibus* 10.14 (12.281 K.).

state, of a moderately pale colour.<sup>4</sup> Sweat differed only in being more thoroughly refined than urine and it was derived not only, like urine, from the humours inside the vessels but also from those which had permeated into the body's substance.<sup>5</sup> It was a product of the third and final step in the concoction and assimilation of food, which took place in the various parts of the body. Urine, in contrast, derived from the second stage in the liver or mesenteric veins and flowed in large measure directly from there to the kidneys. Parts of it also arrived in the rest of the body, however. These parts and the mostly insipid and watery serous fluid which originated from the third stage of concoction could flow back to the kidneys and leave the body via the bladder as urine – or they could pass directly to the outside through the skin as sweat.<sup>6</sup> Sweat was even sometimes said to smell like urine.<sup>7</sup>

Like urine, sweat thus helped the body to get rid of superfluities and waste and to maintain the blood pure and unvitiated.<sup>8</sup> Sweat and urine could also substitute for each other. Experience showed that increased sweating was usually accompanied by a reduced urinary flow, and vice versa.<sup>9</sup> Slevogt even reported the case of a man who could not urinate for eight days until the physician gave him medicine which made his pores contract. In this manner, he reduced his sweat and reestablished the urinary flow.<sup>10</sup>

Sweat (*hidrôs*) was closely linked to the notion of 'occult' or 'insensible' 'perspiration' or 'transpiration' (*adêlon [aisthêsei] diapnoê*). The term can already be found in the work of Galen, who described insensible

<sup>4</sup> Galen, *De simpl. med. temp. ac fac.* 10.14 (12.282 K.) 'Sicut urina naturalis modice est pallida, sic et sudor'.

<sup>5</sup> Galen, *De simpl. med. temp. ac fac.* 10.14 (12.281 K.); idem, *De sanitate tuenda* 4.4 (6.251 K.) 'Sudor quidem succorum, qui in universo corpore abundant, nota est; urina eorum tantum, qui vasis continentur'.

<sup>6</sup> Galen, *De san. tuenda* 4.4 (6.65f K.); Fernel Jean, "Physiologiae libri VII", in idem, *Universa medicina* (Geneva, Chouët: 1644, separate pagination) 230; Zwinger Theodor, *Physiologia medica, eleganti ordine conscripta, rebusque scitu dignissime, Theophrasti item Paracelsi totius fere medicinae dogmatibus illustrata*. Ed. by Jakob Zwinger (Basel, Henricpetri: 1610) 629; cf. Guerin Dionysius, *Daturne certum graviditatis indicium ex urina?* Prop. Guido Patin (Paris, Boisset: 1647<sup>2</sup>), on the third stage of concoction: 'duplex excrementum per caeca cutis spiracula expirat exsudatque sordes et sudor, eandem cum urina habens materiam et eundem generationis modum'.

<sup>7</sup> Schüler Arnold Christoph Friedrich, *De sudore vitioso ingrato plerumque nobilium hospite*. Praes. J. Juncker (Magdeburg, Hilliger: 1756) 20.

<sup>8</sup> Galenus, *In Hippocratis librum de alimento commentarii* 3.17 (15.322f K.).

<sup>9</sup> Musitano, *Opera* 392; Boerhaave Herman, *Lehrsätze der theoretischen Medicin*. Ed. by W.F. Cappel, part 2 (Helmstedt, Fleckeisen: 1790) 429.

<sup>10</sup> Slevogt, *De sudoribus* 6.

transpiration as in many ways similar to sweating. Its matter was so subtle, however, that it could not be seen, which explained why it had no name in ordinary language.<sup>11</sup> It was expelled either through the numerous pores in the flesh and skin or through the very substance of the softer parts of the body.<sup>12</sup> From the early seventeenth century, insensible perspiration or transpiration attracted considerable attention when Santorio Santorio, based on his famous weighing experiments, claimed that the quantity of insensible transpiration surpassed that of all other evacuations taken together.<sup>13</sup> Under certain conditions, the readers of Robert James' *Medicinal Dictionary* learnt, it could even become visible: 'If we look at the shadow of a bare head, on a white wall, in a sun-shiny day, and in the summer season, we shall perceive, very distinctly, the shadow of a flying smoke, rising out of the head, and mounting upward'.<sup>14</sup>

The exact relationship between sweating and insensible transpiration provided one of the few occasions for scholarly controversy in early modern writing about sweat. In his commentary on the Hippocratic *Aphorisms* Galen had quoted Diocles of Carystos' claim that visible sweat was preternatural – that is, pathological – except if it was due to violent physical movement, hot baths or summer heat. Under normal conditions, the innate heat was strong enough to reduce the superfluous humours to such fine, subtle parts that they escaped notice.<sup>15</sup> Galen did not put forward any specific argument against this idea, but he was sceptical.<sup>16</sup> When seventeenth- and eighteenth-century microscopists like Steno and Malpighi arrived at a new understanding of the skin as a highly complex structure containing numerous vessels and nerves as well as special glands,<sup>17</sup> some writers came to the conclusion that visible sweat was secreted by special sweat glands in the skin, while insensible transpiration passed through

<sup>11</sup> Galen, *De san. tuenda* 1.12 (6.67 K.); *In Hippocratis aphorismos commentarii* 1.15 (17B.420f K.).

<sup>12</sup> Galen, *De san. tuenda* 1.12 (6.67 K.).

<sup>13</sup> Santorio Santorio, *Ars de statica medicina aphorismorum sectionibus septem comprehensa* (Venice, Polus: 1614). The work was extremely popular and went through numerous later editions and translations; on Santorio's experiments see Dacome L., "Living with the Chair: Private Excreta, Collective Health and Medical Authority in the Eighteenth Century", *History of Science* 39 (2001) 467–500.

<sup>14</sup> James Robert, *A Medicinal Dictionary*, vol. II (London, Osborne: 1745).

<sup>15</sup> Galen, *In Hipp. Aph. comment.* 1.15 (12.421 K.); rejecting Diocles' view: Galen, *In Hipp. Alim. comment.* 3.17 (15.322 K.); against Diocles but clearly missing his point Sebisch Melchior, *De sudore*. Resp. J. Wepfer (Strasbourg, Welper: 1657).

<sup>16</sup> Galen, *In Hipp. Alim. comment.* 3.17 (15.322 K.).

<sup>17</sup> Slevogt, *De sudoribus* 10; on the role of microscopy see Wilson C., *The Invisible World. Early Modern Philosophy and the Invention of the Microscope* (Princeton, N.J., 1995).

the fine terminal endings of the vessels and nerves or through fine pores in the skin.<sup>18</sup> Most authors, however, believed the matter of sweat and insensible transpiration to be essentially the same. In their view, insensible transpiration reflected quite simply the excretion of the finer and more volatile parts of serum, which heat had resolved into vapours.<sup>19</sup> Whether droplets of sweat became visible or not depended only on the quantity and temperature of the fluid and on the speed at which the skin dried.<sup>20</sup>

As the Galenic description of sweat as a serous excretion already suggested, sweat and insensible transpiration were both, like urine, closely linked to another bodily humour: serum. The term was commonly used in early modern medical writing to refer generally to the thinner, more watery parts of the blood, which, according to some authors, could be seen to separate from the red parts when blood was left sitting for a while after blood-letting.<sup>21</sup> This watery part of the blood was declared as useful and necessary because it enabled the blood to flow more easily, especially through the narrower vessels. When this thinning fluid or 'serum' was too abundant or too crude or impure, however, parts of it had to be evacuated.

The Latin term *serum* simply means 'whey', the watery residue from making cheese. It thus also evoked images of a 'colamen' or 'colamentum', that is, of a more or less active process of sieving or filtering the blood, which left the coarser or more solid parts behind.<sup>22</sup> Like the kidneys, which were similarly said to act as a 'sieve' for the serum,<sup>23</sup> the narrow pores of the skin (or, as Aristotle had suggested,<sup>24</sup> the narrow terminal blood vessels leading towards skin) only let the very watery, subtle parts of the blood pass through, retaining the coarser red parts.

<sup>18</sup> Boerhaave, *Lehrsätze* 425f; Musitano, *Opera* 392f; Slevogt, *De sudoribus* 10.

<sup>19</sup> Slevogt, *De sudoribus* 4; Wedel Johann Adolf, *De transpiratione insensibili et sudore*. Subm. I.G. Cellarius (Jena, Muller: 1728); Herbst Johann Philipp, *De noxia sudoris provocatione praeservationis caussa suscepta*. Praes. A.E. Büchner (Halle-Magdeburg, Hendel: 1750) 12f.

<sup>20</sup> Slevogt, *De sudoribus* 10; similarly Schüler, *De sudore vitioso* 5: 'sudor est auctior transpirationis gradus, ubi serum per poros erumpens, mox peripheriam madidam reddit, mox in veras guttas concrecit'. Baier Christoph Wilhelm, *De sudore sanguineo*. Praes. J. Jantke (Altdorf, Vidua Meyeriana: 1737) 6.

<sup>21</sup> Pinder Udalricus, *Epiphania medicorum* (Nuremberg: 1506) 10 recto, referring to Bernard de Gordon.

<sup>22</sup> Cf. Galen, *Definitiones medicae* 72 (19.365 K.): 'Sudor est tenuis et serosi qui in sanguine est humoris colamen'. Cf. Slevogt, *De sudoribus*.

<sup>23</sup> Savonarola, Michele, "De urinis", in idem, *Practica canonica* (Venice, Valgrisius: 1561) 93 verso–94 recto.

<sup>24</sup> Aristoteles, *De partibus animalium* 3,5, 668b.

The physiology of sweating, like that of urination, thus provided an area where to some degree ‘mechanist’ or ‘hydraulic’ notions had been accepted since Antiquity. The amount of sweat (and insensible perspiration) depended, above all, on three factors: firstly, the degree to which the skin was loose or tight and the pores correspondingly widened or narrowed (which, in turn, reflected the individual nature of the body and its parts as well as the influence of external factors like cold and warmth); secondly, the amount of superfluous or waste fluid in the body and its vessels, which resulted from concoction or from a consumption of the parts; and thirdly, the expelling forces, either the natural expulsive faculties or, again in more mechanical terms, the increased movement and/or fluidity of the blood and humours in the vessels which pushed the fluid into and through the skin. The latter explained why increased bodily heat, hard physical work as well as certain emotions all led to profuse sweating: they caused increased movement of fluids and spirits in the body. Along similar lines, some early modern iatrochemical authors resorted to notions of fermentation and effervescence with corresponding images of a rapid expansion of fluids in the vessels which created sufficient pressure to push the sweat through the pores.<sup>25</sup>

### *Varieties of sweat*

This understanding of sweating as a process of ‘sieving’ the blood and of separating the ‘serum’ helped explain why sweat, though mostly watery by nature, could sometimes contain larger or coarser particles too, depending on the width of the pores, the quality of the blood and the strength of the expelling forces. Sweat, like urine, was said to sometimes contain fat. Among obese people, such fatty sweat was indeed said to be quite frequent<sup>26</sup> and, by increasing sweat and transpiration, obese people could lose fat.<sup>27</sup> Galen had famously claimed that he had made excessively fat people grow slimmer by making them run fast, rubbing their skin and bathing.<sup>28</sup> Vice versa, as Thomas Short declared in 1727, the reason why ‘no age did ever afford more instances of corpulency than our own’ was

<sup>25</sup> Renbourn, “History of Sweat” 217.

<sup>26</sup> Schüler, *De sudore vitioso* 19f.

<sup>27</sup> Ehrlich Johann Christian, *De obesorum ad morbos mortemque proclivitate. Von fetter Leute schwachen und kräncklichen Natur*. Resp. B.L. Tralles (Halle-Magdeburg, Hilliger: 1730) 14.

<sup>28</sup> Galen, *De san. tuenda* 6.8 (6.417f. K.).



that people had overly abundant blood 'stor'd with oily parts, and not sufficiently attenuated and discharged by perspiration'.<sup>29</sup> And since 'all women perspire[d] less than men' it was no wonder that they were particularly prone to plethora and obesity.<sup>30</sup>

Spectacularly, as Aristotle had already observed,<sup>31</sup> sweat could also be bloody.<sup>32</sup> Georg Spörlin in Basel recounted the case of a 12-year old boy whose 'thin, liquid and serous' blood, 'inflamed with feverish heat', was driven through the skin, colouring his shirt and bed-linen with countless bloody spots.<sup>33</sup> According to the *Gospel of Luke* (22.44), Jesus Christ himself had sweat dripping like blood in the Garden of Gethsemane. As with other unusual and uncommon phenomena which, at first sight, seemed to go beyond the order of nature,<sup>34</sup> the topic allowed medical authors to demonstrate their ability to explain such occurrences rationally as a perfectly natural, physiological or pathological event. Sweat, they found, could be bloody when the skin was very loose and the pores excessively widened; or when the humours and spirits were subject to violent movement, as in fever or strong passions; or when the body, as in cachectic patients, was no longer able to perform the third stage of concoction properly, giving rise to very thin, watery blood which could pass more easily through the narrow terminal vessels.<sup>35</sup>

Sweat was also said to be milky and whitish at times, due to the excretion of chyle which had not been sufficiently concocted in the liver.<sup>36</sup> Bile could be present in such amounts that the sweat even left visible yellow stains on the clothes. Concomitant excretion of other matter with sweat

<sup>29</sup> Short Thomas, *A Discourse Concerning the Causes and Effects of Corpulency. Together with the Method for its Prevention and Cure* (London, J. Roberts: 1727) 9; for a more detailed account see Stolberg M., "Abhorreas pinguedinem: Fat and Obesity in Early Modern Medicine (c. 1500–1750)", *Studies in History and Philosophy of Biological and Biomedical Sciences* (in press).

<sup>30</sup> Short, *Discourse* 37.

<sup>31</sup> Arist. *PA* 3.5, 668b.

<sup>32</sup> Alberti Salomon, *Oratio de sudore cruento* (Wittenberg, Lehmann: 1582); Baier, *De sudore sanguineo*. Modern medicine acknowledges such phenomenona as 'hematidrosis' but premodern accounts of bloody sweating may well have to be taken in a much wider sense, including what physicians today would consider as bleeding disorders.

<sup>33</sup> Fabricius Wilhelm, *Opera omnia quae extant* (Frankfurt, Beyer: 1646) 602, letter "De sudore sanguinolento" by Georg Spörlin, Basel, 9 June 1627.

<sup>34</sup> Cf. Daston L. – Park K., *Wonders and the order of nature 1150–1750* (New York: 1998).

<sup>35</sup> Posner Caspar, *De sudore Christi sanguineo*. Subj. A. Buttner (Jena, Sengenwald: 1661); Sebisch, *De sudore*; Brotbeck Johann Conrad, *Hidrologia sive sudoris theoria*. Def. L.T. Breüning (Tübingen, Welrin: 1660) 10f; Slevogt, *De sudoribus* 21.

<sup>36</sup> Slevogt, *De sudoribus* 19; Schüler, *De sudore vitioso* 19f.

could lead to a range of different colours, tinting the sweat blue, grey or even blackish at times.<sup>37</sup>

More subtle admixtures made the taste and smell of sweat vary greatly. Ordinary sweat, as common experience showed, stung the eyes and produced a salty taste in the mouth.<sup>38</sup> Certain foodstuffs, like garlic, or drugs, like moschus, were known to change the odour of sweat.<sup>39</sup> In most cases, however, sweating people quite simply emanated a foul, unpleasant stench, men generally more than women.<sup>40</sup> Stinking sweat was said to be particularly common among old people and Jews and among people suffering from cacochymia, fever, leprosy and scabies, all diseases associated with foul, corrupt humours.<sup>41</sup>

The smell and consistency of sweat also depended on the site where it was excreted and to the degree to which the site was exposed to fresh air.<sup>42</sup> On the head, Herman Boerhaave explained, sweat was fatty, on the forehead more watery, under the armpits it was frequently somewhat viscous and it had the strongest smell on the feet where it tended to thicken into blackish impurities, especially between the toes.<sup>43</sup> Even many young women who were otherwise quite pretty, Klein complained in 1837, sweated from their armpits with a stench that was hard to bear, and nothing stank worse than many people's sweaty feet.<sup>44</sup>

Sweat could be thick and thin, sharp or mild, and it could also vary in temperature. Some early modern writers described cold sweat as a particularly bad sign. It often suggested a weakness of the internal heat and was observed in patients who suffered from dangerous fevers or who were in pain or indeed in 'agone', at the brink of death.<sup>45</sup>

In view of the many variations of sweat, depending on bodily constitution, age, sex, way of life and disease, the examination of sweat could have evolved into an important diagnostic tool. Galen had already recommended that the physician should inspect the sweat and, if necessary, ask the patient to describe its taste as well. He reported that some physicians even tasted their patients' sweat for that purpose.<sup>46</sup> But no consistent tradition

<sup>37</sup> Slevogt, *De sudoribus* 19; Schüler, *De sudore vitioso* 19f.

<sup>38</sup> Schüler, *De sudore vitioso* 6.

<sup>39</sup> Boerhaave, *Lehrsätze* 429.

<sup>40</sup> Boerhaave, *Lehrsätze* 428.

<sup>41</sup> Slevogt, *De sudoribus* 22.

<sup>42</sup> Slevogt, *De sudoribus* 7.

<sup>43</sup> Boerhaave, *Lehrsätze* 428.

<sup>44</sup> Klein P.J.L., *Quaedam de sudoris differentia in morbis* (Berlin: 1837) 35.

<sup>45</sup> Sebisch, *De sudore* (no pagination); Slevogt, *De sudoribus* 23.

<sup>46</sup> Galen, *De san. tuenda* 4.4 (6.251 K.); idem, *In Hippocratis librum de humoribus commentarii* 2.1 (16.217 K.).

of 'hidroscopy' or 'sudoroscopy' comparable to uroscopy ever developed.<sup>47</sup> Presumably this was, above all, for practical reasons: in contrast to urine, sweat was only rarely found to be coloured and it also could not easily be collected and inspected, let alone put into a bottle and sent to a physician.

### *A salutary excretion*

For medical practitioners and lay people alike, the ultimate purpose of sweating remained largely undisputed. Like other bodily evacuations, from faeces, urine and menstrual blood to tears and nasal discharge,<sup>48</sup> sweating and insensible transpiration cleansed the body of superfluities and of potentially harmful, dangerous, polluting matter. Sweat thus preserved health by keeping harmful substances from accumulating in the first place and, in times of sickness, it provided one of the principal pathways through which Nature drove out the morbid matter. In the early seventeenth century, Santorio's experiments were seen to provide quantitative proof of the sheer volume of fluid which was excreted every day in this manner and further underlined the paramount importance of sweat and, above all, insensible transpiration.<sup>49</sup>

Based on this understanding of sweating as a beneficial and purifying excretion, the perception of sweat and sweating was somewhat ambivalent. While the evacuation of sweat was in most cases highly welcome, the potentially harmful matter which the body eliminated via sweating tended to be described in quite negative terms. Sweat was associated with pollution and shame. When lay people mentioned sweat in their writings they sometimes even added apologetic expressions like '*salva venia*' or '*salva reverentia*', as they more commonly did in the case of faeces and urine (but also, for example, when they mentioned pigs).<sup>50</sup> The perception of

<sup>47</sup> Rübel Johann Friedrich, *Medicinische Abhandlung, wie man in denen Kranckheiten aus dem Urin, Schweiß, und aus dem Stuhlgang ein richtiges Urtheil fällen soll* (Augsburg, Lotter: 1756).

<sup>48</sup> Galen, *In Hipp. Hum. comment.* 2.1 (16.216f K.).

<sup>49</sup> Santorio, *Ars statica*.

<sup>50</sup> E.g. Stadt- und Universitätsbibliothek Frankfurt, Senckenbergarchiv, letter from J.M. Schmidt, Mainz, 27 March 1725, describing a lack of sweating from hands and feet; Universitätsbibliothek Jena, Ms. Prov. fol. 26 (16) 375 verso-376 recto, report on the death of Anna Duchess of Saxony by the deacon J. Altenburger 1613, quoting the dying duchess' complaint 'wie salva venia sie aus der Maßen die vergangene Nacht sehr geschweißt hätte'; Kantonsbibliothek St. Gallen, correspondence of S. Schobinger, letter from Sister Afra, 3 May 1632 about the illness of another nun: 'thut Reuerentz die gantz Nacht nichts dan schwitzen'.

sweat is reminiscent in this respect of that of menstruation. Because menstrual blood was considered as harmful and polluting, its copious evacuation at regular intervals was of the utmost importance and suppressed menstruation was regarded as a major cause of female pathology.<sup>51</sup>

The positive perception of sweating as a salutary excretion reflected overarching notions and images of a salutary cleansing which we find described for other bodily evacuations. It provides a particularly good illustration, however, of the reasons why such notions and images remained such a persistent feature of medical culture. After all, in contemporary eyes, the healthy effects of sweating were constantly confirmed and validated by what physicians and patients took to be self-evident and self-explanatory experience. One of the most common observations in this respect was that of a 'critical sweat', especially in fevers.<sup>52</sup> Patients suffering from an acute or intermittent fever frequently improved markedly or at least felt relieved after copious sweating – which they took as a proof that the body had successfully freed itself of the morbid matter.<sup>53</sup> When the 'English sweat' ravaged Europe in the late fifteenth and early sixteenth centuries, it was widely believed among physicians and lay people alike that only copious sweating for at least 24 hours could help get rid of the poison and save the victims' lives.<sup>54</sup> Even long-standing, chronic diseases sometimes improved after a 'good sweat'. Johann Georg Bövingh, for example, had boils and rashes all over his face and body when he was a student of theology. Medicines were of no avail until finally, after half a year of suffering, 'Nature herself went to work, and evacuated an incredible sweat'. His skin lesions healed and he was no longer ashamed to move among people.<sup>55</sup>

Frequently patients and physicians also took the quality, the foul smell, the bitter or sour taste or indeed the colour of sweat to provide direct

<sup>51</sup> Stolberg M., "The Monthly Malady: A History of Premenstrual Suffering", *Medical History* 44 (2000) 301–322, esp. 316f.

<sup>52</sup> Cf. Sennert Daniel, *Opera omnia* (Lyons, Huguetaun: 1656), vol. II, L2, c8 'vix febris aliqua integre sine sudore finitur'; the notion was still alive in the nineteenth century (see Klein, *De sudoris differentia* 9).

<sup>53</sup> E.g. Institut für Geschichte der Medizin der Robert Bosch-Stiftung Stuttgart, Hahnemannarchiv B331341, letter from husband of the sick A. Schmidt, 29 December 1833, reporting her subjective feeling of relief after sweating.

<sup>54</sup> See e.g. Klump Anthonius, *Eyn kurtz Regiment und Consilium für die erschrockenlichen schnellenn Kranckheyt, der englisch Schweiß genant* (Freiburg im Breisgau, J. Juliaccensis: 1529).

<sup>55</sup> Bövingh Johann Georg, "Die Lebensbeschreibung des Johann Georg Bövingh (1676–1728)", Bachmann E. (ed.), *Rotenburger Schriften* 48/49 (1978) 121.

sensory evidence of the harmful, corrupt nature of the waste or morbid matter which the body eliminated by sweating. The destructive force of that morbid matter could even be observed outside the body. Thus a patient of Friedrich Hoffmann's in the eighteenth century repeatedly suffered from fever and rashes. 'My sweat', he wrote, 'was sometimes so acrid that it not only eroded the skin of my chest and temples and made it sore, but it also made my shirt so brittle that when you touched it, it ripped right away, as if vitriolic acid had been smeared on it'.<sup>56</sup> The effects could last for a long time. Even after repeated washing of her clothes, one of Haller's female patients felt 'a horror' all over her body and especially under her arms, when she put on a dress which she had worn during her sickness the previous summer.<sup>57</sup>

Such observations and the lay interpretation of sweating in general were closely connected with a notion which medical historians so far seem to have totally ignored, namely the notion of a space 'between the flesh and the skin'. The idea occurs quite frequently in early modern medical literature and lay writing and was still widely found by nineteenth-century ethnographers.<sup>58</sup> According to this notion, waste or morbid matter frequently accumulated 'between flesh and skin', 'zwischen Fleisch und Haut', 'entre chair et cuir'.<sup>59</sup> From there, the accumulated matter could eventually pass through the pores of the skin to the outside. In this sense, some patients complained of an itch, a pricking or a burning 'between the skin and flesh'. Indeed, a patient of Samuel Tissot in the eighteenth century even described an 'undulation' or 'shuddering' in his shoulders, a feeling 'as if my skin were peeling off' or 'like someone were blowing air between skin and flesh'; in this way, he thought, his sweat was making itself felt as it pushed to the outside.<sup>60</sup>

<sup>56</sup> Hoffmann Friedrich, *Medicina consultatoria* (Halle, Renger: 1721), vol. I, 237–240, letter from an unidentified 63-year old patient.

<sup>57</sup> Burgerbibliothek Bern, correspondence of A. von Haller, A94 21/26, letter from an unidentified patient, ca. 1760.

<sup>58</sup> Flügel D., *Volksmedizin und Aberglaube im Frankenwalde* (Munich: 1863) 52; Brenner-Schäffer W., *Darstellung der sanitätlichen Volkssitten und des medizinischen Volks-Aberglaubens im nordöstlichen Theile der Oberpfalz* (Amberg: 1861) 25f, 58.

<sup>59</sup> Pansa Martin, *Köstlicher und heilsamer Extract der gantzen Artzneykunst* (Leipzig, Gross: 1618) 178; Staatsbibliothek Berlin, Ms.germ. fol. 421a, 313 recto-314 verso, letter from Wulf von Closter (ca. 1576); Krafft H.U., *Reisen und Gefangenschaft Hans Ulrich Kraffts*, ed. Hassler K.D. (Stuttgart: 1861) 222f. ('zwischen Hautt und Flaisch'); Bibliothèque Cantonale et Universitaire Lausanne-Dorigny (BCUL), Fonds Tissot, letter from Mme Monget, 2 November 1776 ('entre chair et cuir').

<sup>60</sup> BCUL, Fonds Tissot, undated account of M de Lihu's disease, with a letter from his brother, 26 April 1785; see also ibidem letter from Mme Arthaud, 1 September 1768; ibidem

*Suppressed sweat*

This notion of a space between flesh and skin, where sweat and morbid humours collected before they passed through the skin, also gave a very concrete meaning to the widespread fear that sweating might be suppressed. When sweat was retained too long between the skin and the flesh, Martin Pansa warned, it turned foul and more acrid and salty, causing scabies, leprosy and other skin affections.<sup>61</sup> Physicians and lay people alike ranked a 'suppressed' sweat among the leading causes of illness and death. Especially when a habitual, long-standing sweat was interrupted, deadly dangers loomed. Thus even when a patient's sweat gave rise to an awful stench the physicians had to take great care not to unduly interrupt or suppress it.<sup>62</sup>

Again the personal experience of patients and relatives confirmed such notions. Thus Achatius Trotzberg, in 1578, asked Leonhard Thurneisser in Berlin for advice because he had developed pain in his belly and limbs about a year after his constant sweating from legs and feet had diminished. He was confident that, if only his former sweat could be restored, his health would improve again.<sup>63</sup> Similarly, a patient of Tissot, some 200 years later, found his habitually sweaty feet quite a nuisance. But when he carelessly put fat on them during a long walk, he suffered terrible consequences. Almost instantly, the transpiration decreased and never came back, and from that same time his eyes started aching and his sight grew weaker and weaker – a clear indication, from a contemporary perspective, that the harmful matter which, until then, had been excreted from the feet had now turned towards the eyes.<sup>64</sup> In another case, F.C. Gotter's father developed heavy nosebleeding, vertigo and other head ailments after the copious sweating from his feet had suddenly stopped after many years, for some unknown reason.<sup>65</sup>

---

letter from Mme Chenou, 26 June 1793; Staatsbibliothek Berlin, Ms. germ. fol. 420b, 118 recto-119 recto, letter from Caspar von Hobergk, 9 March 1577.

<sup>61</sup> Pansa, *Extract* 178; similarly Etmüller Michael, "Collegium consultatorium", in idem, *Opera omnia theórica et practica* (Lyons: 1685) 142.

<sup>62</sup> Klein, *De sudoris differentia* 38.

<sup>63</sup> Staatsbibliothek Berlin, Ms. germ. fol. 422a, 5 recto, letter to L. Thurneisser, 15 June 1578.

<sup>64</sup> BCUL, Fonds Tissot, letter from M Bruckner, 29 November 1789.

<sup>65</sup> Gotter Friedrich Cornelius, *Idionosologia, sive morborum, quos in se ipso expertus est, enarratio* (Erfurt, Heringius: 1735) 4f.

The most commonly described cause of a suppressed sweat was cold. Cold, whether it affected the body from the inside or from the outside, made the skin contract, narrowed the pores and vessels and thus diminished or blocked the evacuation of sweat through the skin. On this basis, eighteenth- and early nineteenth-century physicians and patients still frequently attributed diseases to drinking cold water, especially after physical exercise, or to careless exposure to cold air or water, for example a walk in the cold moist morning air.<sup>66</sup> Among ordinary people, the fear of suppressing a healthy sweat apparently also resulted in a marked aversion against fresh air in the sick-room.<sup>67</sup> In nineteenth-century Germany, physicians still complained about patients and relatives who refused to open the windows when they visited patients, in spite of what the physicians perceived as a literally sickening stench. In the eyes of ordinary people, exposing the patient even to a moment of cold draught could have deadly consequences.<sup>68</sup>

Early modern learned physicians also pointed out other potential causes of suppressed sweating. Abundant hair or, even worse, wigs blocked perspiration and caused fluxes, migraines, eye disorders and the like.<sup>69</sup> More commonly, dirt was said to obstruct the pores and to block the exit of sweat and transpiration through the skin. In fact, at the time, medical advice to keep the body clean was usually based not on fears of contagion but on the need to keep the pores clean and permeable.<sup>70</sup>

### *Prophylactic and therapeutic sweating*

The belief in the beneficial effects of sweating also lay behind its widespread prophylactic and therapeutic use among ordinary lay people. According to the physicians, patients suffering from fevers especially were routinely kept very warm, often by several layers of heavy blankets.<sup>71</sup>

<sup>66</sup> BCUL, Fonds Tissot, letter from Lieutenant Roussany, 10 June 1774.

<sup>67</sup> Tissot Samuel Auguste, *Advice to the People in General, with Regard to their Health*, tr. Kirkpatrick J. (London, Becket and de Hondt: 1765) 48f.

<sup>68</sup> Bayerische Staatsbibliothek München Cgm 6774, collection of more than 200 Bavarian medical ethnographies written around 1860.

<sup>69</sup> Pansa, *Extract* 182; Jacquin [Abbé Armand Pierre], *De la santé* (Paris, Durand: 1762) 292; Hufeland, *Makrobiotik* 202–204.

<sup>70</sup> Pansa, *Extract* 182–186.

<sup>71</sup> Röttenbeck Johann Georg, *De sudore praeter naturam* (Altdorf, Meyer: 1676); Slevogt, *De sudoribus* 13f; Carrère J.-B.-F., *Handbuch der Krankenpflege* (Strasbourg, Treuttel: 1787)



Hippolitus Guarinonius in Austria – whose often sarcastic account should however be taken with a grain of salt – claimed that some patients went even further and tried to cure their fevers by spending half an hour or an hour lying on a slate in a warm bread oven, after the bread had been baked, risking literally being roasted.<sup>72</sup> The ‘people’ generally believed, Samuel August Tissot observed in the 1760s, ‘that all distempers are cured by sweat; and that to procure sweat, they must take abundance of hot and heating things, and keep themselves hot’.<sup>73</sup> Sweating also seems to have been quite popular as a prophylactic, especially in the spring and fall,<sup>74</sup> and, in Austria, according to Guarinonius, the common folk and many from the higher ranks, too, took a sweat bath every Saturday.<sup>75</sup> Different types of bath could be used in order to force a good sweat: the heated air of a ‘Laconian bath’, a ‘sudatorium vaporosum’, or simply warm water, either in natural thermal baths or at home where people prepared baths with river water and herbs.<sup>76</sup>

Eighteenth-century physicians like Tissot were increasingly critical of such practices, as of other potent evacuatives, by which, they claimed, patients were ‘with great probability taking pains to kill themselves’.<sup>77</sup> But sudorifics and the somewhat milder diaphoretics had long been a mainstay of learned medicine, too.<sup>78</sup> Birch bark, saffron, bezoar, wine and pepper were frequently used for this purpose, especially in fevers but also in many other diseases. Frictions – that is, rubbing the skin – and warm baths were also widely prescribed to promote sweating.<sup>79</sup>

### *The humoral economy of sweat*

It is by far the beneficial effects of sweating that predominate in early modern medical writing and lay accounts alike. But there was also

---

39; Mosse Marcus, *De transpirationis et sudoris dignitate. Diss. medico-pathologica* (Berlin: 1832) 22f.

<sup>72</sup> Guarinonius Hippolitus, *Die Grewel der Verwüstung menschlichen Geschlechts* (Ingolstadt, Angermeyer: 1610) 898f.

<sup>73</sup> Tissot, *Advice* 47.

<sup>74</sup> Tissot, *Advice* 47.

<sup>75</sup> Herbst, *De noxia sudoris provocatione* 5–7.

<sup>76</sup> Eysel Johann Philipp, *Disputatio inauguralis medica exhibens sudorifera*. Subj. J.C. Pfauzcius (Erfurt, Grosch: 1712), no pagination.

<sup>77</sup> Tissot, *Advice* 47.

<sup>78</sup> Pansa, *Extract* 178.

<sup>79</sup> Brooke H., *Hygieine. Or a Conservatory of Health* (London, G. Whittington: 1650) 214f; Eysel, *Sudorifera*.

another side to sweating. Like menstruation or haemorrhoidal bleeding, sweating was, at times, excessive. When the body lost too much 'serum' in this manner, patients became exsiccated,<sup>80</sup> and their blood and the other humours thickened. Their movement became sluggish or it ceased altogether, leading to stagnation and putrefaction.<sup>81</sup>

Excessive sweating, the physicians warned, also caused to a loss of subtle, mobile vital spirits and of innate heat.<sup>82</sup> Adolescents were at particular risk. They were sometimes found to have their growth stunted from excessive sweating.<sup>83</sup> In spite of the widely-acknowledged risks of suppressed perspiration, in the seventeenth century, Francis Bacon even advised elderly people, whose spirits began running lower, to use cold water in order to keep their pores closed and thus to preserve the native heat and the radical moisture inside their bodies as long as possible.<sup>84</sup> This fear of excessive losses of native heat and radical moisture or, more generally, of precious vital matter, due to sweating was supported, in particular, by the experience of consumption which was often associated with abundant and, in particular, nocturnal sweat.<sup>85</sup> To the physicians it seemed clear that this often thick and viscous sweat resulted from a melting away of the body's own substance and made consumptives become thin and emaciated.<sup>86</sup>

The perception of sweating thus provides a striking illustration of the precarious balance between excretion and retention, between openness and closure, which characterised the early modern understanding and experience of the body in many areas. There is, however, a second tension inherent in the early modern perception of sweating and the skin. A permeable skin and open pores permitted a salutary excretion of harmful matter but, once the pores were widened, matter could also move in the opposite direction from the outside towards the innermost parts. Sometimes this might be welcome, when restoring, balsamic substances were absorbed in

<sup>80</sup> Staats- und Universitätsbibliothek Göttingen, Ms. Meibom 86, letter from P. Püchler about the sick Geheime Rätin von Brunnstatt, 4 February 1679.

<sup>81</sup> Tissot, *Advice* 48.

<sup>82</sup> Pansa, *Extract* 178; Musitano, *Opera* 141: 'nativi calidi aliquid dissipat, corpus dissolvit, vires dejecit, labefacit'.

<sup>83</sup> Wedel Georg Wolfgang, *Physiologia medica quatuor sectionibus distincta* (Jena, Bielkuis: 1680) 189.

<sup>84</sup> Bacon Francis, *The Historie of Life and Death. With Observations Naturall and Experimental for the Prolonging of Life* (London, Mosley: 1638) 182.

<sup>85</sup> E.g. Library of the Wellcome Institute, London, Western Manuscripts, Ms. 6114, letter from M Fasnacht [?], 4 May 1801.

<sup>86</sup> Vater Christian, *De sudore colliquativo*. Def. G.F. Clauder (Wittenberg, Kreusig: 1715); Büchner Andreas Elias, *De sudore colliquativo*. Def. G.C. Schlichter (Halle, Hendel: 1757).

this manner,<sup>87</sup> but much more frequently it was considered as life-threatening. Far into the nineteenth century, corrupt, miasmatic air was feared as a major cause of epidemic disease and open pores inevitably facilitated its entry into the body. Indeed, for the very reason that sweat freed the sick from morbid, corrupt matter, the mere presence of fellow human beings in the same room or even just the same town could become a serious health hazard. Without any direct physical contact, the subtle, vaporous excretions from the sick might enter the bodies of others in their vicinity through the skin.<sup>88</sup> For similar reasons, health advice books warned against the effects of dirty bedding and linen which affected the vital matter in the body with a repulsive, hostile odour.<sup>89</sup> Certainly when people became sick, common folk, according to J.-B.-F. Carrère, generally considered it necessary to keep sweating patients' skin dry and to change their bed-linen, shirt and cap in order to constantly remove the excreted sweaty matter.<sup>90</sup>

### *Conclusion. Change and continuity*

There is some evidence of change in the early modern understanding and perception of sweat, at least among learned medical authors and their readers. Microscopy associated sweating more closely with glands and other specific structures in the skin. Chemical analysis led to attempts to attribute the variable consistency and smell of sweat to chemical ingredients such as sulphur or salt.<sup>91</sup> The balance between the fears of suppressed evacuation on the one hand and of excessive losses of vital matter on the other shifted, in the long run, to a greater stress on economy and a growing appreciation of a tight skin and of relatively closed bodily boundaries as a safeguard of health. Cold air and cold water, which had long been feared as major causes of a potentially fatal suppression of sweat, increasingly came to be praised as invigorating and as strengthening the fibres instead.

Above all, however, the history of sweating is the story of a striking persistence of notions and images of the body. The new chemical and microscopic findings and the range of new medical theories of human physiology and pathology which late seventeenth- and eighteenth-century

---

<sup>87</sup> Hufeland Christoph Wilhelm, *Makrobiotik oder die Kunst das Leben zu verlängern* (Berlin: 1823<sup>5</sup>) 202.

<sup>88</sup> Stolberg M., *Die Cholera im Großherzogtum Toskana. Ängste, Deutungen und Reaktionen im Angesicht einer tödlichen Seuche* (Landsberg: 1995), esp. 102–116.

<sup>89</sup> Pansa, *Extract* 182f.

<sup>90</sup> Carrère, *Handbuch* 35.

<sup>91</sup> Schüler, *De sudore* 6; Slevogt, *De sudoribus* 7.

physicians put forward seem to have had precious little impact on the learned understanding of sweating and hardly any on that of ordinary lay people. Indeed, to this very day the notion that sweat cleanses or 'detoxifies' the body has remained a widely accepted part of our cultural heritage and continues to shape many people's experience of sweating as liberating, even though from the viewpoint of modern Western medicine this makes little sense.

The history of sweating thus also illustrates a fundamental methodological point, which is of considerable importance not only for writing the history of sweating but for that of the body and medical theory in general. It has often been observed that the imagery and practices associated with the body in sickness and health tend to be particularly resistant to the innovation and change wrought by new scientific theories or discoveries. Harvey's theory of the circulation of the blood, for example, all but destroyed the theoretical rationale of blood-letting as a mainstay of early modern therapy. Patients and physicians were firmly convinced, however, that they had experienced its liberating, salutary effects countless times. In the end, rather than relinquishing this time-honoured practice, new reasons were found to account for its unquestioned efficacy. Along very similar lines, early modern physicians and lay-people saw their deeply rooted belief in the salutary effects of sweating and other bodily evacuations constantly confirmed by daily experience. Numerous patients recovered after copious sweating or after having taken a drastic purgative. In retrospect, we may attribute this to the placebo effect and, above all, to the natural course of the disease. Most patients get better, at least temporarily, no matter what treatment they receive, especially in acute diseases like the fevers so common at the time. To early modern patients and those around them such improvement was, however, clear evidence that the natural or artificial evacuation of matter had worked. This frequent observation validated, in turn, the underlying idea that the body was indeed threatened, above all, by putrid, morbid matter which it had to expel.

It seems that prevailing notions and images of the body can in fact become so deeply rooted in this manner that they shape the physical perception of the body itself, and of its workings. Since historians have access to physical experience generally only through the words which are used to express it, the effects of culture on bodily sensation are notoriously difficult to pin down. But even patients' written accounts leave little doubt, for example, that early modern 'hysterical' women who complained about their uterus rising up in their bellies and taking away their breath experienced a physical sensation entirely unfamiliar to women today; or that people, growing up with a very physical, somatic understanding of

the emotions, thought they literally 'sensed' how their blood and spirits withdrew to the inside of their bodies at the sight of something frightful.<sup>92</sup> Similarly, early modern people 'sensed' the polluting peccant matter pushing outwards when it collected 'between flesh and skin' and they physically 'felt' hot vapours rise from their belly to their heads and faces, when sweating was suppressed.

Inevitably, once learned medical concepts and the notions and images of the body in sickness and in health which they carry with them have become a deeply rooted and pervasive element of a culture in this manner, they become a powerful force in their own right. New medical theories on the body or on individual bodily phenomena like sweating will not be able simply to do away with such deeply ingrained and, literally, embodied notions and images. After all, contemporaries, including the physicians as embodied men of their time, 'know' these notions and images to be true, based on what they take for their naturally given bodily perception and experience.

Medical historians tend to identify the dominant medical discourse with the fairly coherent, logical theories expounded in medical textbooks. The relationship between theory and the culturally framed lived body is, however, a more complex and, above all, a thoroughly dialectical one. New medical theories will only be accepted as meaningful if they sufficiently accommodate established notions and images of the body, even if that leads to some degree of tension or outright contradiction. Careful analysis of the elaborate explanatory models and systematic theories of learned physicians is thus only a first, though an indispensable, step towards a full understanding of early modern concepts of sweating and other bodily phenomena. The meanings of bodily phenomena like sweating in the daily lives of ordinary people and even in daily medical practice are probably more fruitfully explored by looking at the semantic network of terms, notions, images and accepted practices which developed around them over the centuries.<sup>93</sup> They provided the theories with flesh and bones; they shaped what contemporaries perceived as a naturally given physical experience; and they decided, to a substantial degree, on the limits of plausible and acceptable medical innovation.

---

<sup>92</sup> Stolberg, *Homo patiens* 233–239.

<sup>93</sup> On the notion of 'semantic networks' see the classic paper by Good B.J., "The Heart of What's the Matter. The Semantics of Illness in Iran", *Culture, Medicine and Psychiatry* 1 (1977) 25–58.

### Selective bibliography

- ALBERTI SALOMON, *Oratio de sudore cruento* (Wittenberg, Lehmann: 1582).
- ARISTOTLE, *De partibus animalium*: ed./comm. Lenox J.G. (Oxford: 2001).
- BACON FRANCIS, *The Historie of Life and Death. With Observations Naturall and Experimental for the Prolonging of Life* (London, Mosley: 1638).
- BAIER CHRISTOPH WILHELM, *De sudore sanguineo*. Praes. Jacobus Jantke (Altdorf, Literis Viduae Meyerianae: 1737).
- BOERHAAVE HERMAN, *Lehrsätze der theoretischen Medicin*, ed. Cappel W.F. (Helmstedt, Fleckeisen: 1790) [Part 2].
- BÖVINGH JOHANN GEORG, "Die Lebensbeschreibung des Johann Georg Bövingh (1676–1728)", in Bachmann E. (ed.), *Rotenburger Schriften* 48/49 (1978) 92–181.
- BRENNER-SCHAEFFER W., *Darstellung der sanitätlichen Volkssitten und des medizinischen Volks-Aberglaubens im nordöstlichen Theile der Oberpfalz* (Amberg: 1861).
- BROOKE H., *Hygieine. Or a Conservatory of Health* (London, G. Whittington: 1650).
- BROTBECK JOHANN CONRAD, *Hidrologia sive sudoris theoria*. Def. L.T. Breüning (Tübingen, Welrin: 1660).
- BÜCHNER ANDREAS ELIAS, *De sudore colliquativo*. Def. G.C. Schlichter (Halle, Hendel: 1757).
- CARRERE J.-B.-F., *Handbuch der Krankenpflege* (Strasbourg, Treuttel: 1787).
- DACOME L., "Living with the Chair: Private Excreta, Collective Health and Medical Authority in the Eighteenth Century", *History of Science* 39 (2001) 467–500.
- DASTON L. – PARK K., *Wonders and the Order of Nature 1150–1750* (New York: 1998).
- EHRlich JOHANN CHRISTIAN, *De obesorum ad morbos mortemque proclivitate. Von fetter Leute schwachen und kräncklichen Natur*. Resp. B.L. Tralles (Halle-Magdeburg, Hilliger: 1730).
- EYSEL JOHANN PHILIPP, *Disputatio inauguralis medica exhibens sudorifera*. Subj. J.C. Pfauzium (Erfurt, Grosch: 1712).
- FABRICIUS WILHELM, *Opera omnia quae extant* (Frankfurt, Beyer: 1646).
- FERNEL JEAN, "Physiologiae libri VII", in idem, *Universa medicina* (Geneva, Chouët: 1644).
- FLÜGEL D., *Volksmedizin und Aberglaube im Frankenwalde* (Munich: 1863).
- GALEN, *Opera omnia*: ed. Kühn C.G., 20 vols. (Leipzig: 1821–1833).
- GOTTER FRIEDRICH CORNELIUS, *Idionosologia, sive morborum, quos in se ipso expertus est, enarratio* (Erfurt, Heringius: 1735).
- GUARINONIUS HIPPOLITUS, *Die Grewel der Verwüstung menschlichen Geschlechts* (Ingolstadt, Angermeyer: 1610).
- GUERIN DIONYSIUS, *Daturne certum graviditatis indicium ex urina?* Prop. Guido Patin (Paris, Boisset: 1647<sup>s</sup>).
- HAESER H. (ed.), *Scriptores de sudore anglico superstites* (Jena, F. Maukium: 1847).
- HERBST JOHANN PHILIPP, *De noxia sudoris provocatione praeservationis caussa suscepta*. Praes. A.E. Büchner (Halle-Magdeburg, Hendel: 1750).
- HOFFMANN FRIEDRICH, *Medicina consultatoria* (Halle, Renger: 1721) [vol. I].
- HUFELAND CHRISTOPH WILHELM, *Makrobiotik oder die Kunst das Leben zu verlängern* (Berlin: 1823<sup>s</sup>).
- JACQUIN [ABBE ARMAND PIERRE], *De la santé* (Paris, Durand: 1762).
- JAMES ROBERT, *A Medicinal Dictionary* (London, Osborne: 1745), vol. II.
- KLEIN P.J.I.L., *Quaedam de sudoris differentia in morbis*. Diss. med. (Berlin: 1837).
- KLUMP ANTHONIUS, *Eyn kurtz Regiment und Consilium für die erschrockenlichen schnellenn Kranckheyt, der englisch Schweiß genant* (Freiburg im Breisgau, J. Juliacensis: 1529).
- KRAFFT H.U., *Reisen und Gefangenschaft Hans Ulrich Krafts*, ed. Hassler K.D. (Stuttgart: 1861).
- MOSSE MARCUS, *De transpirationis et sudoris dignitate*. Diss. medico-pathologica (Berlin: 1832).

- MUSITANO CARLO, *Opera omnia, seu trutina medica, chirurgica, pharmaceutico-chymica* (Geneva, Cramer and Perachon: 1716), vol. II.
- PANSA MARTIN, *Köstlicher und heilsamer Extract der gantzen Artzneykunst* (Leipzig, Gross: 1618).
- PINDER UDALRICUS, *Epiphanie medicorum* (Nuremberg: 1506).
- POSNER CASPAR, *De sudore Christi sanguineo*. Subj. A. Buttner (Jena, Sengenwald: 1661).
- RENBOURN E.T., "The History of Sweat and the Sweat Rash from Earliest Times to the End of the 18th Century", *Journal of the History of Medicine and Allied Sciences* 14 (1959) 202–227.
- , "The Natural History of Insensible Perspiration: A Forgotten Doctrine of Health and Disease", *Medical History* 4 (1960) 135–152.
- RÖTENBECK JOHANN GEORG, *De sudore praeter naturam* (Altdorf, Meyer: 1676).
- RÜBEL JOHANN FRIEDRICH, *Medicinische Abhandlung, wie man in denen Kranckheiten aus dem Urin, Schweiß, und aus dem Stuhlgang ein richtiges Urtheil fällen soll* (Augsburg, Lotter: 1756).
- SANTORIO SANTORIO, *Ars de statica medicina aphorismorum sectionibus septem comprehensa* (Venice, Polus: 1614).
- SAVONAROLA, MICHELE, "De urinis", in idem, *Practica canonica* (Venice, Valgrisius: 1561).
- SCHÜLER ARNOLD CHRISTOPH FRIEDRICH, *De sudore vitioso ingrato plerumque nobilium hospite*. Praes. J. Juncker (Magdeburg, Hilliger: 1756).
- SEBISCH MELCHIOR, *De sudore*. Resp. J. Wepfer (Strasbourg, Eberhard Welper: 1657).
- SENNERT DANIEL, *Opera omnia* (Lyons, Huguetan: 1656), vol. II.
- SHORT THOMAS, *A Discourse Concerning the Causes and Effects of Corpulency. Together with the Method for its Prevention and Cure* (London, J. Roberts: 1727).
- SLEVOGT JOHANNES ADRIAN, *De sudoribus*. Subj. Pilling J.G. (Jena, Werther: 1697).
- STOLBERG M., "Abhorreas pinguedinem: Fat and Obesity in Early Modern Medicine (c. 1500–1750)", *Studies in History and Philosophy of Biological and Biomedical Sciences* (in press).
- , *Die Cholera im Großherzogtum Toskana. Ängste, Deutungen und Reaktionen im Angesicht einer tödlichen Seuche* (Landsberg: 1995).
- , *Die Harnschau. Eine Kultur- und Alltagsgeschichte* (Cologne-Weimar, Böhlau: 2009).
- , *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (Weimar: 2003).
- , "The Monthly Malady: A History of Premenstrual Suffering", *Medical History* 44 (2000) 301–322.
- TISSOT SAMUEL AUGUSTE, *Advice to the people in general, with regard to their health*, tr. Kirkpatrick J. (London, Becket and de Hondt: 1765).
- VATER CHRISTIAN, *De sudore colliquativo*. Def. G.F. Clauder (Wittenberg, Kreusig: 1715).
- WEDEL GEORG WOLFGANG, *Physiologia medica quatuor sectionibus distincta* (Jena, Bielkuis: 1680).
- WEDEL JOHANN ADOLF, *De transpiratione insensibili et sudore*. Subm. I.G. Cellarius (Jena, Muller: 1728).
- ZWINGER THEODOR, *Physiologia medica, eleganti ordine conscripta, rebusque scitu dignissime, Theophrasti item Paracelsi totius fere medicinae dogmatibus illustrata*, ed. Zwinger J. (Basel, Henricpetri: 1610).



OF THE FISHERMAN'S NET AND SKIN PORES.  
REFRAMING CONCEPTIONS OF THE SKIN IN MEDICINE 1572–1714

Mieneke te Hennepe

*Summary*

Between 1572 and 1714, existing conceptions of the skin as being porous were reaffirmed by visual microscopic evidence. Platonic understandings of the skin as a fisherman's net were both reformulated in new vocabularies and reframed by new findings in microscopic observations. In this paper I argue that the transition from macroscopic anatomy to microscopic anatomy changed the anatomical views of the skin yet left medical practice in the European context intact. The skin, as the ultimate layer of communication between the body and the world, was seen as a porous tactile part of the body, capable of excreting noxious matter in sweat. Moreover, historical conceptions and visualisations of the skin tell us about changing concepts of the body, and ultimately about the way the body is constructed. While the skin as a symbolic layer has been the subject of studies in art and literature, little is known about the medical and physiological meanings of skin in early modern history. This paper seeks to investigate the physiology of the skin and thus deepen the history of the body as a changing subject of interpretation and analysis, through comparisons of works by Girolamo Mercuriale to early microscopic findings by such scholars as Nehemiah Grew and Antoni van Leeuwenhoek.

'our entire skin is as one pore'  
Antoni van Leeuwenhoek, 1674<sup>1</sup>

The skin as a bodily structure occupied anatomists, physiologists and surgeons in the past in many different ways. In the late seventeenth century, microscopy introduced a new dimension. From being the most obvious structure that needed no depiction, according to Vesalius, skin became a target for such microscopists as Antoni van Leeuwenhoek and Nehemiah Grew. What the microscope revealed was a skin that abounded in pores. What did this mean for existing anatomical and physiological conceptions of the skin? How were medical perceptions of skin challenged by the new natural philosophy? In this paper I argue that microscopic findings

---

<sup>1</sup> Leeuwenhoek Antoni van, *The Collected Letters of Antoni van Leeuwenhoek*, vol. I (Amsterdam: 1939) 181: Letter 12, 18 oktober 1674.

concerning skin in the late seventeenth century were part of the reframing of skin in a novel intellectual framework with surprisingly little effect on medical practice or patient experiences. The way microscopic investigations into the skin were discussed by physicians can tell us much about the relationship between technology and medical practices, and about the physiological understandings of skin throughout the period between 1572 and 1714. With the emergence of microscopic studies, existing (multiple) understandings of the skin as a 'fisherman's net' were reformulated in new vocabularies and reframed by microscopic evidence and drawings. Here I will focus particularly on the skin's pores, which closely defined the interplay and exchanges of sweat and other substances between the body and the outer world. Capable of expelling sweat and other matter from the body, the pores could at the same time import air and other substances into the body. As such, the pores of the skin symbolise one important yet paradoxical role of the skin for the physiology of the healthy body: it is at once a large structure for safeguarding the integrity of the body while simultaneously being a layer of exchange and interaction between body and environment.

Although the skin as a symbolic layer has been the subject of studies in art and literature, little is known about the medical and physiological meanings of skin in early modern history. Scholarly interest in the body has in recent years brought the skin to the attention of interdisciplinary groups and historians.<sup>2</sup> Literary critics, psychologists, art historians and others have begun to analyse the skin in our present culture and in psychological or bodily experience.<sup>3</sup> By tracing the meanings and understandings of skin in history, these scholars have relieved the skin of its self-evident image. Literary scholar Steven Connor, for example, has underlined the multiple readings of the skin in Western culture in his work *The Book of Skin* (2004). By studying a wide variety of medical and literary texts,

---

<sup>2</sup> For cultural histories of the body see Corbin A. – Courtine J.-J. – Vigarello G. (eds.), *Histoire du Corps*, 3 vols. (Paris: 2005–2006). On the history of specific parts of the body see Benthien C. – Wulf C. (eds.), *Körperteile. Eine kulturelle Anatomie* (Reinbek bei Hamburg: 2001). For recent work on the human body see for example Egmond F. – Zwijnenberg R. (eds.), *Bodily Extremities. Preoccupations with the Human Body in Early Modern European Culture* (Aldershot: 2003). On the depiction of skin in art see Fend M., "Bodily and Pictorial Surfaces: Skin in French Art and Medicine, 1790–1860", *Art History* 28 (2005) 311–339.

<sup>3</sup> Anzieu D. *The Skin Ego. A Psychoanalytic Approach to the Self* tr. Turner C. (New Haven, Conn: 1989); Joost T. – Everdingen J.J.E. van (eds.) *Omtrent de huid. Cultuurhistorische verkenningen* (Amsterdam-Overveen: 1996); Benthien C., *Skin. On the Cultural Border between Self and the World* tr. Dunlap T. (New York: 2002); Connor S. *The Book of Skin* (London: 2004).

Connor emphasises the various cultural codifications of the skin from complexion and disfigurement to scenes of religious anointing.<sup>4</sup> Cultural studies of skin have thus stressed the idea of the skin as a cultural subject shaped by history. Similarly, a recent volume on the medically visualised body discusses the bodily interior as 'an historical, social and cultural construct, constituted in the interchange between technology, knowledge, representation and media'.<sup>5</sup> In line with these analyses, this paper seeks to investigate the physiology<sup>6</sup> of the skin and thus deepen the history of body and skin as a changing subject of interpretation and investigation.

Between 1572 and 1714, a shift from macroscopic anatomy to microscopic investigations resulted in changing anatomical views of the skin. Yet in medical practice the function of the skin as a medium in the movements of bodily fluids remained much the same. I will discuss how the skin was scrutinised and described while still retaining its bodily role as a medium of exchange. I show how different authors at different times were occupied with the skin, and with the pores of the skin in particular. First, I focus on Greek and Renaissance understandings of skin. As a starting point I use one of the most important early discussions of skin diseases by the Italian Girolamo Mercuriale of 1572, in which Galenic and Platonic understandings of the skin were prominent (*De morbis cutaneis*). I then turn to the microscopic investigations of the skin between 1665 and 1700 where I discuss exemplary works by the Dutch microscopist Antoni van Leeuwenhoek (1632–1723) and the London physician Nehemiah Grew (1641–1712). Visual articulation of the microscopic make-up of the skin was a crucial aspect of the inquiry into the functioning of the healthy body. Furthermore, the attention paid to the pores of the skin exemplified the interest in porosity expressed at the time in natural philosophy. Finally, I look at the work of the English surgeon Daniel Turner (*De morbis cutaneis*, 1714), who integrated the microscopical anatomy of the skin as an explanatory framework for his practices relating to skin diseases and treatments.

<sup>4</sup> Connor, *The Book of Skin* chs. 1, 3 and 7.

<sup>5</sup> Vall R. van de – Zwijnenberg R. (eds.), *The Body Within. Art, Medicine and Visualization* (Leiden: 2009).

<sup>6</sup> My understanding of the term physiology here follows Andrew Cunningham, who argued that, until 1800, physiology referred to a fundamental part of medical knowledge, and later also to natural philosophy; depending on human anatomy in the search for causes. See Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.

*Plato and the fisherman's net*

For physicians in Renaissance Europe, the framework for defining the role of the skin in the healthy or diseased body was set by the Greek classics.<sup>7</sup> For the Italian physician Girolamo Mercuriale (1530–1606), the diseased skin was a subject for his book *De morbis cutaneis*, 1572.<sup>8</sup> Mercuriale, ‘the most eminent Italian Professor of medicine in the last quarter of the sixteenth century’, edited the *Opera omnia* of both Galen and Hippocrates.<sup>9</sup> In *De morbis cutaneis*, Mercuriale displayed his profound knowledge of the classics such as Galenic teachings, Hippocratic texts and Aristotle. Relying on a multitude of classical sources, he provided descriptions of such conditions as baldness, scabies, exanthemata and leprosy. Drawing on Plato’s *Timaeus*, Mercuriale defined the skin as a ‘fisherman’s net’ (*nassulae piscatoriae*) because of its purpose as a common bond holding together the separate body parts in accordance with Hippocrates.<sup>10</sup> According to Mercuriale, the skin had no other function other than receiving waste materials, as Galen had taught.<sup>11</sup>

The analogy of the skin as a fisherman’s net (or fish-trap) is important, as it refers to a conception of the skin as an inherently porous layer of exchange. For the purpose of clarity, I want to turn briefly to Plato’s *Timaeus* in order to understand how Mercuriale read this analogy.<sup>12</sup> In

<sup>7</sup> See Nutton V., “Greek Science in the Sixteenth-Century Renaissance”, in Field J.V. – James F.A.L. (eds.), *Renaissance and Revolution. Humanists, Scholars, Craftsmen and Natural Philosophers in Early Modern Europe* (Cambridge: 1993) 15–28; 16 and Cunningham A., *The Anatomical Renaissance. The Resurrection of the Anatomical Projects of the Ancients* (Aldershot: 1997).

<sup>8</sup> Sutton L.R., *Sixteenth Century Physician and his Methods. Mercurialis on Diseases of the Skin. The first book on the subject (1572)* (Kansas City: 1986). On Mercuriale see also Arcangeli A. – Nutton V. (eds.), *Girolamo Mercuriale. Medicina e cultura nell'Europa del Cinquecento* (Florence: 2008).

<sup>9</sup> Nutton, “Greek Science in the Sixteenth-Century Renaissance” 18.

<sup>10</sup> Sutton, *Sixteenth Century Physician* 11. Original text in Mercuriale Girolamo, *De morbis cutaneis et omnibus corporis humani excrementis tractatus locupletissimi* (Venice, Paulum and Antonium Meietos fratres: 1572), 1 ‘Divinus Plato in Timaeo cutim nassulae piscatoriae adsimilaverit, quod etiam adnotavit Galenus in commentariis in Timaeum’.

<sup>11</sup> For Galen on skin see, for example, Green R.M., *A Translation of Galen's Hygiene (De Sanitate Tuenda)* (Springfield: 1951) 103 ‘And we deem it best in this to stretch the massaged parts, for the purpose of expelling through the skin all the excrement which is between the skin and the underlying flesh’; and 131 ‘Now obstruction [of the pores] occurs from thin and thick excrements, when they go too abundantly to the skin’.

<sup>12</sup> I acknowledge that Mercuriale’s reading of Plato’s *Timaeus* depends on the translations and commentaries available at the time. For practical purposes, however, I will trace the idea of a ‘fisherman’s net’ here as discussed by J.M. Cornford in *Plato's Cosmology. The Timaeus of Plato* (London: 1937).

Cornford's translation and interpretation of *Timaeus*, the porous role of the skin in respiration is explicit: the body not only transpires through pores all over the skin, but currents of air and fire also 'thrust' in a circular motion into the body.<sup>13</sup> Plato on transpiration, discussing pores in the skin, quotes Empedocles:

Thus do all things draw breath and breathe it out again. All have bloodless tubes of flesh extended over the surface of their bodies; and at the mouths of these the outermost surface of the skin is perforated all over with pores closely packed together, so as to keep in the blood while a free passage is cut for the air to pass through. Then, when the thin blood recedes from these, the bubbling air rushes in with an impetuous surge; and when the blood runs back it is breathed out again.<sup>14</sup>

Plato's diagram of currents of air and fire in the body was described by the classical scholar Cornford in 1937 as a 'wheel or fish-trap'.<sup>15</sup> According to this concept, currents of air 'sink into the body through its pores'; at other times, the term 'channels' is used.<sup>16</sup> What is clear, however, is how complex the image of the skin as a fish-net or fish-trap was in Plato's work.

Mercuriale assimilated the many ideas about skin into his 1572 work on skin diseases. His descriptions of diseases resonate with the conception of the skin as a receptacle for waste and as a layer of exchange. He directly referred to Plato's *Timaeus* and to the comments on *Timaeus* by Galen.<sup>17</sup> As a layer of exchange, the skin was subject to different kinds of diseases. Abnormalities of the hair, for example, resulted from abnormalities of the pores through which waste material, which formed the hairs, was expelled.<sup>18</sup> If the pores became too narrow and closed up, the hair would fall out.<sup>19</sup> On the other hand, certain problems could be relieved through manipulation of the skin pores by external treatment. Keeping the skin pores open or purging the pores was dictated by Aristotle and

<sup>13</sup> Cornford, *Plato's Cosmology* 306.

<sup>14</sup> Quote in Cornford, *Plato's Cosmology* 306–307. Translation of Empedocles, *Fragmenta* 100 'ὥδε δ' ἀναπνεῖ πάντα καὶ ἐκπνεῖ· πᾶσι λίφαιμοι | σαρκῶν σύριγγες πύματον κατὰ σῶμα τέτανται, | καὶ σφιν ἐπὶ στομίοις πυκιναῖς τέτρηνται ἄλοξιν | ῥινῶν ἔσχατα τέρθρα διαμπερές, ὥστε φόνον μὲν | κεῦθεν, αἰθέρι δ' εὐπορίην διόδοισι τετμήσθαι. | ἐνθεν ἔπειθ' ὁπότεν μὲν ἀπαῖξι τέρην αἶμα, | αἰθὴρ παφλάζων καταΐσσεται οἴδατι μάργω, | εὔτε δ' ἀναθρώισκη, πάλιν ἐκπνέει'.

<sup>15</sup> Cornford, *Plato's Cosmology* 308–315. See also Longrigg J., *Greek Rational Medicine. Philosophy and Medicine from Almageon to the Alexandrians* (London: 1993) 135–141.

<sup>16</sup> Cornford, *Plato's Cosmology* 314. Plato, *Timaeus* 78d–78e.

<sup>17</sup> See also Larrain C.J., *Galens Kommentar zu Platons Timaios* (Stuttgart: 1992).

<sup>18</sup> Sutton, *Sixteenth Century Physician* 15. Cf. Galen on hair colour and pores; see Singer P.N., *Galen. Selected Works* (Oxford: 1997) 252–253.

<sup>19</sup> Sutton, *Sixteenth Century Physician* 16.

Galen, for example.<sup>20</sup> Mercuriale's *De morbis cutaneis* thus shows how ancient theories on the function and workings of the skin were incorporated into sixteenth-century views on the diseased human body.

Authors of anatomical and medical texts had defined *skin* in different ways.<sup>21</sup> In the anatomical tradition of dissection, skin was not primarily an object of physiological interest. Andreas Vesalius in *De humani corporis fabrica* (1543) expressed the understanding of skin as an in-between structure, an intermediary.<sup>22</sup> Defined as a 'native tegument covering all parts of the body', skin was intermediate between 'hardness and softness', between 'sinew and flesh', and between 'bloodless' and 'abounding in blood'.<sup>23</sup> According to Vesalius, there was no need for a depiction of the skin as 'anyone who has ever performed a dissection, or assisted someone dissecting, will have no need of a picture, as these parts are the same in all cases'.<sup>24</sup> In dissection and artistic representations of the body, the human flayed figure without skin – or *écorché* – was a common image. In some cases, the skin of the *écorché* figured as part of the title page on anatomical treatises.<sup>25</sup> Besides offering a symbolic reference to classical and Christian myths of flaying,<sup>26</sup> the *écorché* also demonstrates the visual

<sup>20</sup> Sutton, *Sixteenth Century Physician* 45. See also Green, *A translation of Galen's Hygiene (De Sanitate Tuenda)* (Springfield: 1951) 131–132 'Causes and treatment of constriction of the pores'.

<sup>21</sup> The historian Renbourn published two articles in which he described the histories of sweat and insensible perspiration chronologically, from a somewhat positivist and anachronistic view, often without providing page references to original works. However, his articles do provide a first insight into the different ways of understanding skin throughout the centuries. See Renbourn E.T., "The History of Sweat and the Sweat Rash from Earliest Times to the End of the 18th Century", *Journal of the History of Medicine and Allied Sciences* 14 (1959) 202–227; Renbourn E.T., "The Natural History of Insensible Perspiration", *Medical History* 4 (1960) 135–152.

<sup>22</sup> Richardson W.F. – Carman J.B., *On the Fabric of the Human Body*. Book II. *The Ligaments and Muscles. A Translation of De Humani Corporis Fabrica Libri Septem* (San Francisco: 1999) 140–145.

<sup>23</sup> Richardson – Carman, *On the Fabric of the Human Body* 140. This intermediate state is investigated by Vesalius in a macroscopic manner: observing the resistance of the skin in different places of the body, or the differences in distribution of hair. Apart from the skin, the *derma* in Greek, Vesalius differentiated the outmost cuticle, the *epidermis*.

<sup>24</sup> Richardson – Carman, *On the Fabric of the Human Body* 140.

<sup>25</sup> On the *écorché* and other aspects of skin in book culture see: Herzog August Bibliothek, *Haut zwischen 1500 und 1800. Verborgen im Buch – Verborgen im Körper* (Wolfenbüttel: 2004) and Connor, *The Book of Skin* 13–18.

<sup>26</sup> For an extended analysis of flaying in the visual arts see Benthien, *Cultural Border* 63–94; and Bohde D., "Skin and the Search for the Interior: The Representation of Flaying in the Art and Anatomy of the Cinquecento", in Egmond F. – Zwijnenberg R. (eds.), *Bodily Extremities. Preoccupations with the Human Body in early Modern European Culture* (Aldershot: 2003) 10–47.

counterpart of Vesalius' anatomical dissection of the skin [Fig. 1]. The very act of auto-dissection of the skin emphasised the role of the skin as a mere protective tegument, that can be removed like clothing.

For physicians like Mercuriale or the French physiologist Jean Fernel, skin was of interest in the context of the formation of human anatomy and in the movements of fluids.<sup>27</sup> In Fernel's *Physiologia*, he described how 'narrow vents' in the skin 'give passage to exhalation from the inside'.<sup>28</sup> He furthermore explained different movements of substances through the skin, from 'nutriment' and 'spirit' provided by veins and arteries<sup>29</sup> to the exhalation of air, 'thinner spirit' or the entry of fluid.<sup>30</sup> While Vesalius was concerned with the macroscopic anatomical make-up of skin, Fernel discussed movements, respiration and formation of skin in the living body.

Other physicians and surgeons continued this role of the skin as an intermediate layer of interchange between body and environment into the early seventeenth century. The French surgeon Ambroise Paré (1509–1590) described how use of the 'true skin' (*derma*) was to 'keep safe and sound the continuity of the whole body, and all the parts thereof, from the violent assault of all external dangers [...], it is penetrated with many pores, as breathing-places, as we may see by the flowing out of sweat'.<sup>31</sup> This idea of porosity continued to play a fundamental part in consequent anatomical and natural philosophical descriptions of the skin. In *The History of Life and Death* (1638), the philosopher Sir Francis Bacon (1561–1626) considered how keeping air out of the body could extend life.<sup>32</sup> The exclusion of air from the body was achieved by 'shutting or filling the pores', for example by using cold baths and applying binders such as resin, ointments, oils or pomanders to the skin.<sup>33</sup> In this way, the winter was kept out and the spirits in, although suppressing sweat could be a cause of discomfort, as well as introducing the possibility of the entrapped spirits in

<sup>27</sup> Forrester J.M., *The Physiologia of Jean Fernel* (1567) (Philadelphia: 2003) 148–149. See also: Fernel Jean, *Medicina* (Paris, Wechel: 1554) 56.

<sup>28</sup> Forrester, *The Physiologia of Jean Fernel* (1567) 149.

<sup>29</sup> Forrester, *The Physiologia of Jean Fernel* (1567) 149.

<sup>30</sup> Forrester, *The Physiologia of Jean Fernel* (1567) 209.

<sup>31</sup> Paré Ambroise, *The Workes of that Famous Chirurgion Ambrose Parey translated out of Latine and compared with the French by Th. Johnson* (London, Th. Cotes and R. Young: 1634) 89. In the original French publication of 1579 Paré wrote 'il faut entendre qu'il est poreux et transpirable, ainsi qu'on peut voir par les sueurs', in: Paré Ambroise, *Les oeuvres d'Ambroise Paré, conseiller et premier chirurgien du Roy* (Paris, Gabriel Buon: 1579), LXXXIX.

<sup>32</sup> Bacon Francis, *The Historie of Life and Death. With Observation Naturall and Experimental for the Prologing of Life* (London, I. Okes: 1638).

<sup>33</sup> Bacon, *The Historie of Life and Death* 186.





Fig. 1. Gasparo Becerra, "Standing male écorché", in Juan Valverde de Hamusco, *Historia de la Composición del Cuerpo Humano* (Rome, Salamanca and Lafreri: 1556). Book II, Tabula I. Copper engraving. Image © Wellcome Library, London.

the body becoming 'hot'.<sup>34</sup> Natural constriction and opening of the pores in winter and summer was mentioned by Fernel as early as 1567.<sup>35</sup>

The fishing-net metaphor was still in use in the early seventeenth century. The English Galenist physician Helkiah Crooke (1576–1635) reminded his readers in *Mikrokosmographia* (1616) how the existence of skin pores as pin holes in the surface of the skin is evident in sweating and breathing of air, which was why Crooke compared it to a 'fish net' in line with Plato.<sup>36</sup> Crooke derived the role of the skin pores according to their form and size:

These pores are small and almost insensible, least otherwise there should be too free a dissipation of the spirits, yet in some bodies they are narrower or straighter, in some wider, and such do easily melt away in sweat, and are less affected with inward causes: the other sweat very difficultly, and because the excrements are retained, doe easily incurre diseases thereby.<sup>37</sup>

The porosity of the skin implied both dangers and opportunities for treatment in medicine. Sixteenth-century authors in Italy, for example, described the entrance of pestilence through the skin, while creating openings in the skin could at the same time form a treatment to force disease to exit the body.<sup>38</sup> Helkiah Crooke also mentioned the use of saffron and other diaphoretics or sweating remedies to 'relax' the pores.<sup>39</sup>

New mechanist philosophies around 1650 shifted the focus in anatomy away from the purpose of the parts towards particles and actions by contact.<sup>40</sup> In *De Homine* (1664), René Descartes presented his mechanical representation of the human body.<sup>41</sup> Yet, as a physiologist explaining movements of parts and body functions, Descartes still adhered to

---

<sup>34</sup> Bacon, *The Historie of Life and Death* 192. On page 193 Bacon discusses one of the 'discommodities' of anointing with oil: 'The fourth discommodity being of a subtler nature, is the increasing of the detained spirits by shutting the pores [...]'.  
<sup>35</sup> Forrester, *The Physiologia of Jean Fernel* (1567) 291.

<sup>36</sup> Crooke Helkiah, *Mikrokosmographia. A Description of the Body of Man, together with the Controversies and Figures thereto Belonging / Collected and Translated out of all the best Authors of Anatomy, especially out of Gasper Bauhinus and Andreas Laurentius, by Helkiah Crooke* (London, W. Iaggard: 1616) 73.

<sup>37</sup> Crooke, *Mikrokosmographia* 73.

<sup>38</sup> Bohde, "Skin and the search for the interior" 31.

<sup>39</sup> Crooke, *Mikrokosmographia* 73.

<sup>40</sup> French R., "The Anatomical Tradition", in Bynum W.F. – Porter R. (eds.), *Companion Encyclopedia of the History of Medicine* (London-New York: 1993), vol. 1, 91.

<sup>41</sup> Descartes René, *De homine figuris. Et latinitate donatus a Florentio Schuyll* (Leiden, Hackius: 1664).

the idea of circulation of fluids through the pores of the skin.<sup>42</sup> With the introduction of the microscope, a novel anatomy of the skin was visually unravelled. A different focus on porosity thus emerged.

*Microscopic investigations and images of porosity*

Between 1660 and 1700, microscopists produced a new flow of knowledge about the minute details of the constitution of the skin. Historians of science and medicine have shown how practitioners of natural philosophy at this time scrutinised and described the natural world as created by God.<sup>43</sup> Microscopic investigations of the skin were part of this endeavour to discover the body. The skin was now visualised by anatomists using the microscope as a tool for experimental natural philosophy. New drawings seemed to unveil the skin's innermost secrets.

Microscopy was an important new way of investigating the anatomy of the human body.<sup>44</sup> Even the earliest accounts of microscopic observations included descriptions of the skin. As early as 1656, Pierre Borel (1620–1671) reported microscopic observations of 'valves in pores, and the rough scaliness of the skin'.<sup>45</sup> Some ten years later, in his *De externo tactus organo* the Italian Marcello Malpighi (1628–1694) extensively discussed the anatomy of the skin for the first time. He described the different components in and between the layers of the skin using a microscope: nerves, glands, and the source of skin colour. Although the anatomist Nicolas Steno had already argued for the existence of sweat glands, Malpighi now noted the vessels involved in the excretion of sweat. An image of the skin and its microscopic structures appeared in 1685 [Fig. 2] in the atlas of the human body by the anatomist Govert Bidloo (1649–1713). William Cowper (1666–1709),

<sup>42</sup> I refer here to the first French edition, Descartes R., *L'homme et un traité de la formation du foetus* (Paris, Charles Angot: 1664) 26.

<sup>43</sup> See for example Cunningham A. – Williams P., "De-centering the 'Big Picture': The Origins of Modern Science and the Modern Origins of Science", *British Journal for the History of Science* 26 (1993): 407–432.

<sup>44</sup> On microscopy see Fournier M., *The Fabric of Life. Microscopy in the Seventeenth Century* (Baltimore: 1996); LaBerge A. "The History of Science and the History of Microscopy", *Perspectives on Science* 7 (1999) 111–142; Ruestow E.G., *The Microscope in the Dutch Republic. The Shaping of Discovery* (Cambridge: 2004); Wilson C., *The Invisible World. Early Modern Philosophers and the Invention of the Microscope* (Princeton NJ.: 1995).

<sup>45</sup> Ruestow, *The Microscope in the Dutch Republic* 81; Borel Pierre, *Observationum microscopiarum centuria* (The Hague, Adriaan Vlacq: 1656), bound with *De vero telescopii inventore*.

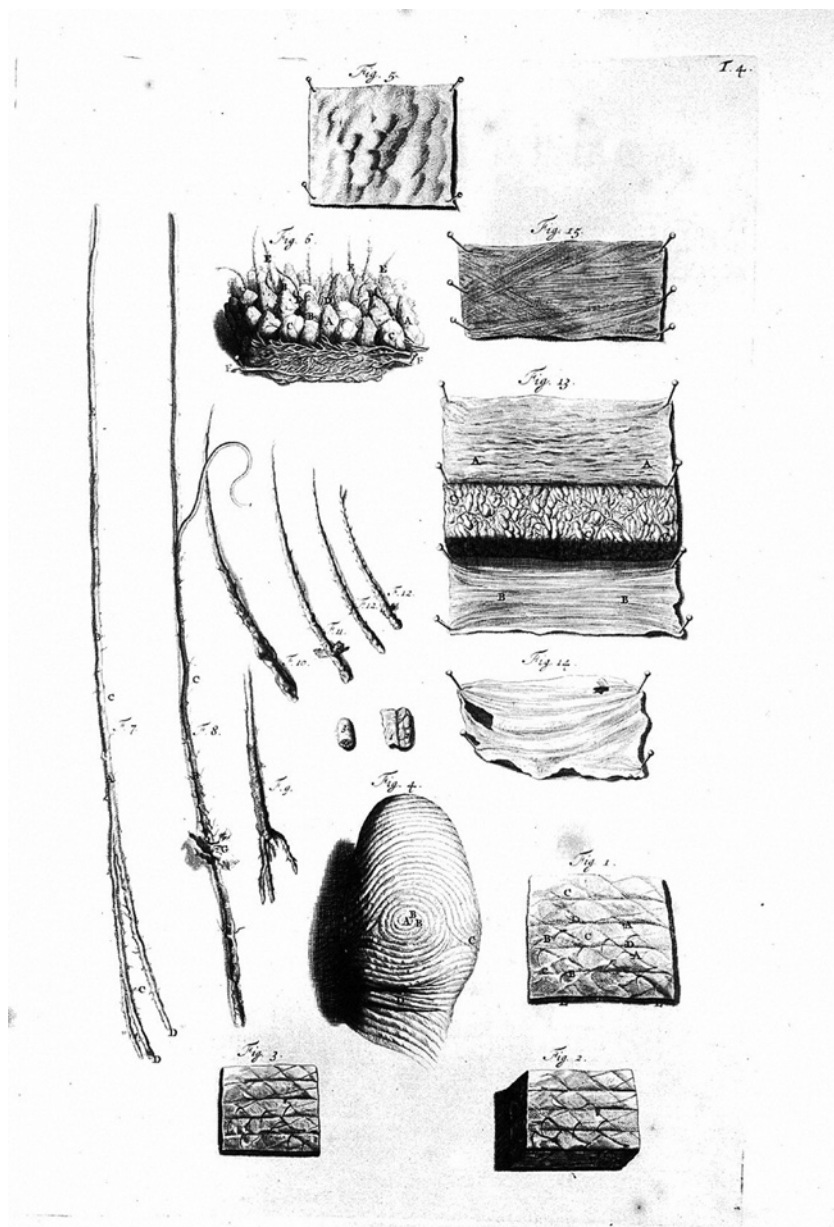


Fig. 2. Gerard de Lairesse, "Microscopical anatomy of the skin" in William Cowper's *The Anatomy of Humane Bodies* (Oxford, S. Smith and B. Walford: 1698).

Tabula 4. Copper engraving. Image © Wellcome Library, London.

using the same images in *The Anatomy of Humane Bodies* of 1698, wrote that it represented 'a Portion of the Cuticula or Scarf-skin, rais'd from the Back of the Hand, and viewed with a Microscope'.<sup>46</sup> He also indicated 'The Perforations or pores, whereby the Sweat is discharged'.<sup>47</sup> For Cowper, as a surgeon, the experimental natural philosophy of microscopy was part of his anatomical investigations of the skin.<sup>48</sup>

During this time of firsts in microscopy, the way perspiration and other matter passed through the skin became of particular interest for microscopists. The existence and role of different types of glands, vessels and ducts in the skin was a matter of discussion among contemporary anatomists, as was the precise nature of the different types of perspiration (sensible and insensible). The goal of the study was to find out more about the role of the skin in the movements of fluids in the body. Cowper assumed that the skin played a role in exporting and importing substances and fluids between different parts such as the hair and glands. The most striking elements of Cowper's account of the skin were his microscopic observations of the hair which, apparently transparent, appeared 'spongy' when seen under the microscope.<sup>49</sup> Even solid structures turned out to be porous.

Clearly, the transition from macroscopic dissection to microscopic observation implied a shift in attention from the solid structures to the character of the spaces in between:<sup>50</sup> a shift towards the analysis of the nature of transport through the skin and the nature and existence of the very pores themselves. Edward Ruestow, a historian of science, noted how a new Cartesian physiology loomed, with the microscopic discoveries of several glands and searches for pores, ducts, vessels, valves and other means of transporting bodily fluids.<sup>51</sup> Similarly, Robert Hooke (1635–1703) studied the pores in cork and solid materials such as marble in his *Micrographia* (1665) [Fig. 3].<sup>52</sup> With regard to the skin, the pores of Plato's fisherman's

<sup>46</sup> Cowper William, *The Anatomy of Humane Bodies* (Oxford, S. Smith and B. Walford: 1698).

<sup>47</sup> Cowper, *The Anatomy of Humane Bodies* text to the Fourth Table.

<sup>48</sup> Wilson P.K., "William Cowper's Anatomy of Human Skin", *International Journal of Dermatology* 31 (1992) 361–363.

<sup>49</sup> Wilson, "William Cowper" 361.

<sup>50</sup> Ruestow, *The Microscope in the Dutch Republic* 64.

<sup>51</sup> Ruestow, *The Microscope in the Dutch Republic* 42, 45. Ruestow describes how the Dutch Cartesian Theodoor Craanen seemed 'to focus on the spaces in between [globules] and the infinitely diminishing particles those spaces perhaps contained' (64).

<sup>52</sup> Hooke Robert, *Micrographia. Or, Some Physiological Descriptions of Minute Bodies made by Magnifying Glasses* (London, J. Martyn and J. Allestry: 1665) 112ff: Observ. XVII. Of the Schematisme of Texture of Cork, and of the Cells and Pores of some other such frothy



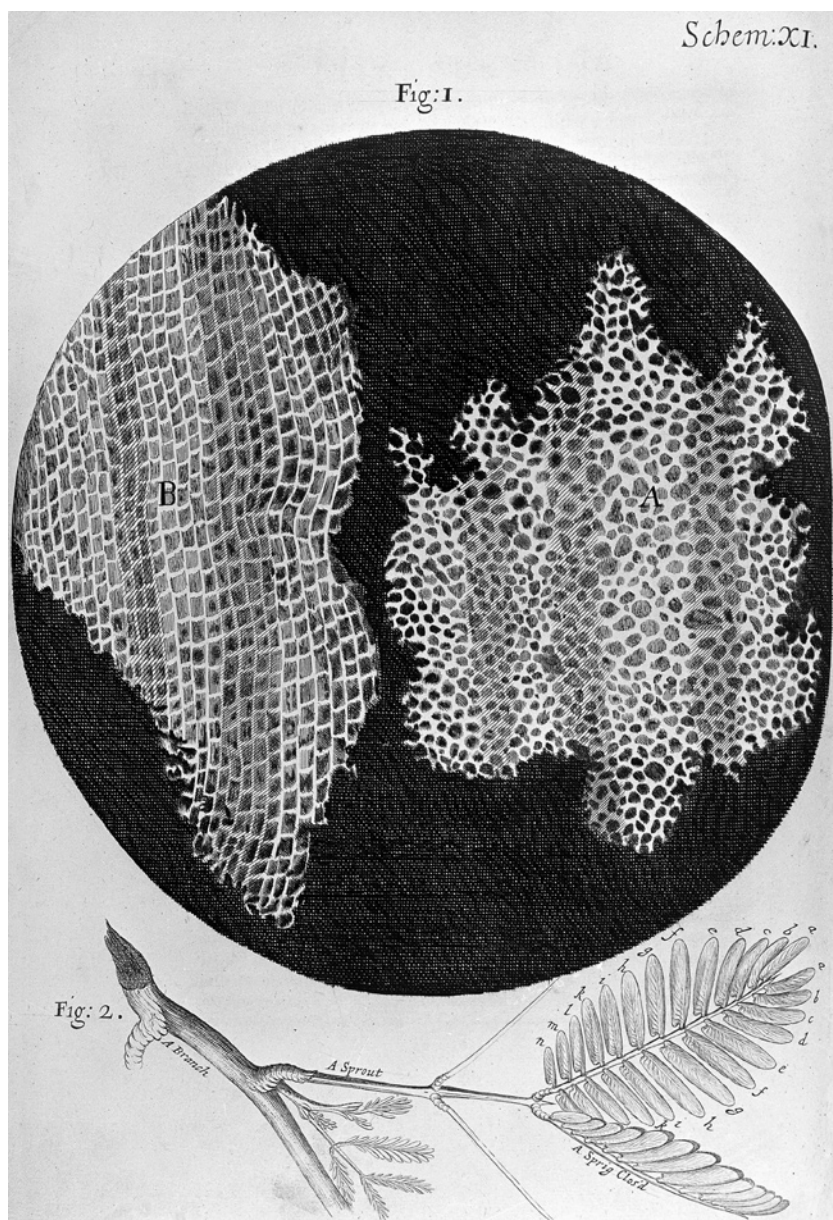


Fig. 3. Porous appearance of cork viewed under a microscope, in Robert Hooke, *Micrographia* (London, J. Martyn & Allestry: 1665) Scheme IX, Fig. 1. Engraved illustration. Image © Wellcome Library, London.

net came under microscopic scrutiny, especially since the holes in the net proved to play an important role in the flows of fluids in the body.

Pictures of pores were first printed in 1684 when Nehemiah Grew communicated his observations on the skin pores in a publication in the *Philosophical Transactions*.<sup>53</sup> In this paper he made a direct connection between microscopic observation of pores in the skin of the hands and feet, and diseases. The fact that the skin contained pores was unquestionable for Grew: perspiration was clear proof of the fact that the skin contained spaces for the excretion of sweat.<sup>54</sup> The pores in the hands and feet, however, he argued were special.<sup>55</sup> Both the position and number of pores were to be the subject of an anatomical investigation. Using an 'indifferent Glass', Grew discovered how the pores were aligned on ridges and were built like fountains, something that was explained in the accompanying drawing [Fig. 4]. The role of the pores was to expel 'noxious and perspirable' elements of the blood, the pores being a convenient open passage-way. This expulsion of waste materials through the pores was stimulated by using the hands and feet. Pain on the soles of the feet and palms of the hands in some diseases fitted with this concept, according to Grew:

These Pores being thus made and secured, are a very convenient and open passage for the discharge of the noxious and perspirable parts of the Blood. Which by continual use of the Hands and Feet, are plentifully brought into them. Whence it is, that the sweat of the Feet, in many people, is much more offensive than that of any other part of the Body. And that many Hypochondriacal Men, and Hysterical Women, have almost a continual burning in the soles of their Feet, and the Palms of their Hands.<sup>56</sup>

Using the microscope, Grew defined the visual and experimental explanation for the existence of these pores. His findings were a source for many physicians, surgeons and others who discussed the skin well into the eighteenth century.

---

Bodies 93ff: Observ. XV. Of Kettering-stone, and of the pores of Inanimate bodies. Hooke described the pores in cork as 'the first microscopical pores I ever saw, and perhaps, that were ever seen, for I have not met with any writer or person that had made any mention of them before this' (113).

<sup>53</sup> Grew Nehemiah, "The Description and Use of the Pores in the Skin of the Hands and Feet, by the Learned and Ingenious Nehemiah Grew, M.D. Fellow of the College of Physicians and of the Royal Society", *Philosophical Transactions* 14 (1684) 566–567.

<sup>54</sup> Grew, "The Description and Use of the Pores in the Skin of the Hands and Feet" 566.

<sup>55</sup> For more on Grew's vitalism and teleology see Garrett B., "Vitalism and Teleology in the Natural Philosophy of Nehemiah Grew (1641–1712)", *British Journal for the History of Science* 36 (2003) 63–81. Specifically on pores see 68.

<sup>56</sup> Grew, "The Description and Use of the Pores in the Skin of the Hands and Feet" 567.



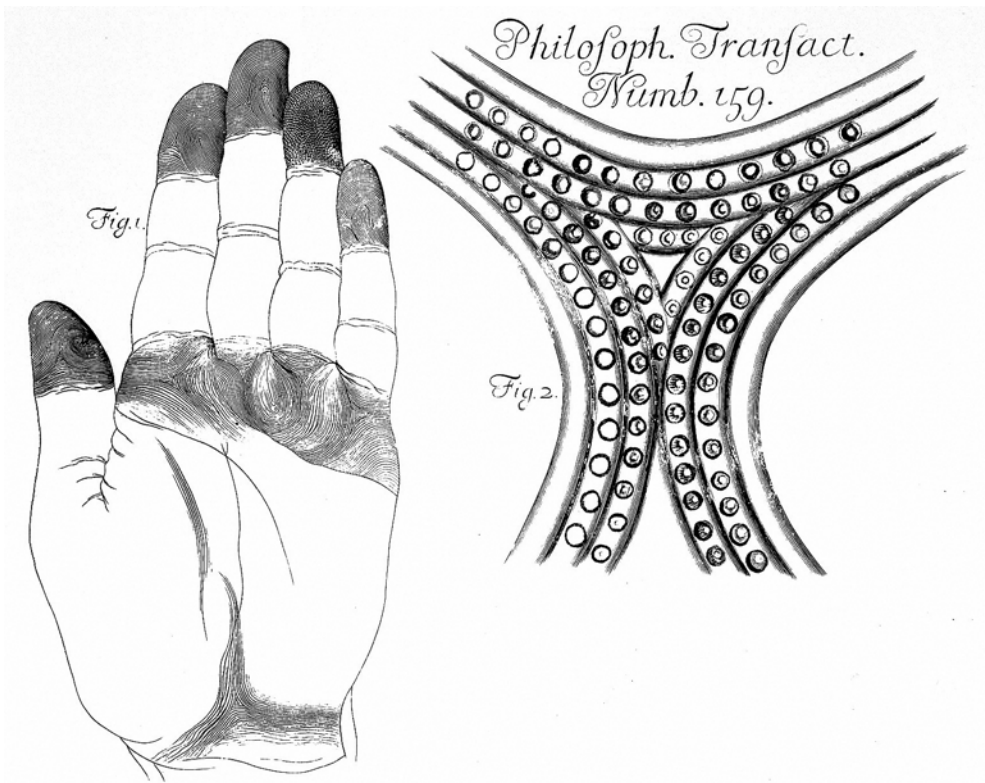


Fig. 4. Pores of the skin of the hands positioned on ridges as depicted by Nehemiah Grew, in *Philosophical Transactions* Volume 14 (1684) 566. Engraving. Image © Wellcome Library, London.

Yet not everybody agreed with Grew's observations of the pores. The findings by the Dutch microscopist Antoni van Leeuwenhoek on the skin initially failed to correspond with Grew's ideas. While van Leeuwenhoek found an abundance of pores in many plant materials, as in the seeds of the cotton plant, he could not agree with Grew on the nature of the pores in the skin. A letter by van Leeuwenhoek was published in the same issue of the *Philosophical Transactions* of 1684.<sup>57</sup> In this letter he described his findings on the 'scales' of the outer skin made using a microscope with a

<sup>57</sup> Leeuwenhoek Antoni van, "An Abstract of a Letter from Mr. Antony Leewenhoek at Delft, dated Sep 17, 1683. Containing some Microscopical Observations, about Animals in the Scurf of the Teeth, the Substance call'd Worms in the Nose, the Cuticula consisting of Scales", *Philosophical Transactions* 14 (1684) 568–574.

high magnification [see Fig. 5 for an example of a van Leeuwenhoek microscope]. Ironically, he described how these scales resembled 'fish-scales' in shape and 'leye upon our body just as they do upon fishes'.<sup>58</sup> Drawings of these scales appeared in fact on the same image in the *Philosophical Transactions* as the illustration of Grew's skin pores [Fig. 6]. Furthermore, van Leeuwenhoek stressed that his findings of the scales suggested that there were no pores in the cuticula, but that the sweat oozes out of the spaces between the scales.<sup>59</sup> Thus, according to van Leeuwenhoek, the body could be seen as 'nothing but a pore', because 'the body may exhale out of 20000 places in a quantity no bigger than what a [grain of] sand will cover'.<sup>60</sup> For van Leeuwenhoek, the skin formed one continuous pore all over the body.

The implications of the microscopic observation of the skin's pores for physiology, medical practice or even patient experiences are not straightforward. Andrew Cunningham showed how, before 1800, anatomy formed a stepping stone for physiology as a thinking discipline, with physiology being a discourse on the motions and grand functions of the human body: respiration, nutrition, and so on.<sup>61</sup> New anatomical knowledge of the skin could thus imply a change in physiological thinking about the role of the skin in the movements of fluids. But not necessarily. Similarly, the responses to natural philosophy from medical practitioners around 1700 were diverse.<sup>62</sup> John Pickstone wrote that the implications of mechanical analogy for medicine in general were minor: 'Some of the explanations changed, but the practice of medicine remained much the same; its form remained biographical and natural historical'.<sup>63</sup>

Records of patient experiences in the eighteenth century do show that patients experienced the concept of porosity in their body image.<sup>64</sup> First-

<sup>58</sup> Van Leeuwenhoek, "An Abstract of a Letter" 572.

<sup>59</sup> Van Leeuwenhoek, "An Abstract of a Letter" 573.

<sup>60</sup> Van Leeuwenhoek, "An Abstract of a Letter" 574.

<sup>61</sup> See Cunningham A., "The Pen and the Sword: Old Physiology – The Pen".

<sup>62</sup> Cook H. J., "The New Philosophy and Medicine in Seventeenth-Century England", in Lindberg D.C. – Westman R.S. (eds.), *Reappraisals of the Scientific Revolution* (Cambridge: 1990) 397–436.

<sup>63</sup> Pickstone J.V., *Ways of Knowing. A New History of Science, Technology and Medicine* (Chicago: 2000) 107.

<sup>64</sup> Patient experiences on skin are hard to come by for the period discussed in this paper, 1572–1714. On eighteenth-century patient records see Duden B., *The Woman beneath the Skin. A Doctor's Patients in Eighteenth-Century Germany* tr. Dunlap T. (Cambridge: 1991); and Pilloud S. – Louis-Courvoisier M., "The Intimate Experience of the Body in the Eighteenth Century: Between Interiority and Exteriority", *Medical History* 47 (2003) 451–472.



Fig. 5. Simple microscope made and used by Antoni van Leeuwenhoek. Leiden, Museum Boerhaave, V7017.



Fig. 6. Scales of the skin resembling 'fish scales' as depicted by van Leeuwenhoek published as illustration in *Philosophical Transactions* 14 (1684).

hand patient accounts of the eighteenth century, among many other things, describe a body of porosity and movement. One patient wrote in a letter how baths 'in opening the pores of the skin, can also dilute the lymph, making it flow easier and, as a result, encourage resolution'.<sup>65</sup> The skin was furthermore perceived as a place where diseases could manifest as blockages, which the surgeon could remove by opening the 'sweat holes'.<sup>66</sup> These descriptions very much continue the existing medical manipulation of skin pores as points for the exchange of fluids by inhalation and excretion, as described in sixteenth-century physiology by Fernel, for example.

Nehemiah Grew's microscopic conception of the skin's pores was adopted by physicians and surgeons to explain the body in health and disease. Grew himself, in an anatomical publication of 1685, stressed how the functioning of the pores in the skin might influence the balancing of body fluids. When, as a result of cold, the pores suddenly constricted and normal perspiration stopped, the redundant matter of the blood would be discharged by the glands to the gut.<sup>67</sup> Furthermore, the conception and image of the pores drawn up by Grew survived in many sources, for example in an abridged collection of the *Philosophical Transactions* in 1705.<sup>68</sup> The London surgeon Daniel Turner (1667–1741), in his *De morbis*

<sup>65</sup> Letter from a patient of Swiss physician Samuel Tissot, Monsieur Torchon Defouchet, quoted on in Pilloud – Louis-Courvoisier, "The Intimate Experience" 469.

<sup>66</sup> Duden, *The Woman beneath the Skin* 121.

<sup>67</sup> Grew Nehemiah, *The Comparative Anatomy of Stomachs and Guts* (London, Printed by W. Rawlins: 1681) 29.

<sup>68</sup> Lowthorp John, *The Philosophical Transactions and Collections, to the Year 1700, abridg'd and dispos'd under General Heads* (London, Royal Society: 1705), vol. III, 9–10, figure 4–5.

*cutaneis* of 1714, combined the microscopic findings of Grew with a re-examination of the Galenic non-naturals.<sup>69</sup> In his book, Turner explained the anatomy of the skin in line with the recent findings of Bidloo, Cowper and Malpighi, among others. In turning to one of the important actions of the body and skin, perspiration, he pointed to the microscopic proof for the existence of tubes and vessels. Moreover, the 'mechanism' of the pores was best described by Nehemiah Grew, according to Turner.<sup>70</sup> Besides this explanation on the nature and working of the pores and perspiration, Turner then discussed the diseases connected with failure of perspiration. Other diseases, such as the itch, could enter through the pores of the skin, corrupting the 'juices' in the glands.<sup>71</sup> Surgeons, as Turner indicated, could manipulate the pores to help the body regain its balance. Turner and his colleagues treated several different diseases by removing blockages, administering sweating remedies, or applying 'Outward remedies' or baths [see Fig. 7 and Fig. 8 for examples of treatments with vapour baths].<sup>72</sup> Thus, by the early eighteenth century, physicians and surgeons like Turner had appropriated and integrated the microscopic findings of the pores as a justification and explanation for their treatments and understandings of body and disease.

### *Conclusions. The spaces in between*

'[...] I cannot but think the doctrine of the small pores of bodies, of no small importance to natural philosophy'. Robert Boyle, 1684<sup>73</sup>

Both Plato's fish-net metaphor and the Galenic concepts of respiration through the pores of the skin were replaced, not only *in vocabulary* but also in explanation, by an interest in the permeability and porosity of the skin, and of the body in general. In late seventeenth-century natural philosophical experiments, the porosity of bodies was at stake. Robert Boyle (1627–1691) demonstrated in his experimental programme how and why

<sup>69</sup> Wilson P.K., *Surgery, Skin and Syphilis. Daniel Turner's London (1667–1741)* (Amsterdam: 1999) 69.

<sup>70</sup> Turner Daniel, *De morbis cutaneis. A treatise of diseases incident to the skin* (London, R. Bonwicke: 1714) 80.

<sup>71</sup> Turner, *De morbis cutaneis* 33.

<sup>72</sup> Wilson, *Surgery, Skin and Syphilis* 68.

<sup>73</sup> Boyle Robert, *Experiments and Considerations about the Porosity of Bodies* (London, S. Smith: 1684) 2.

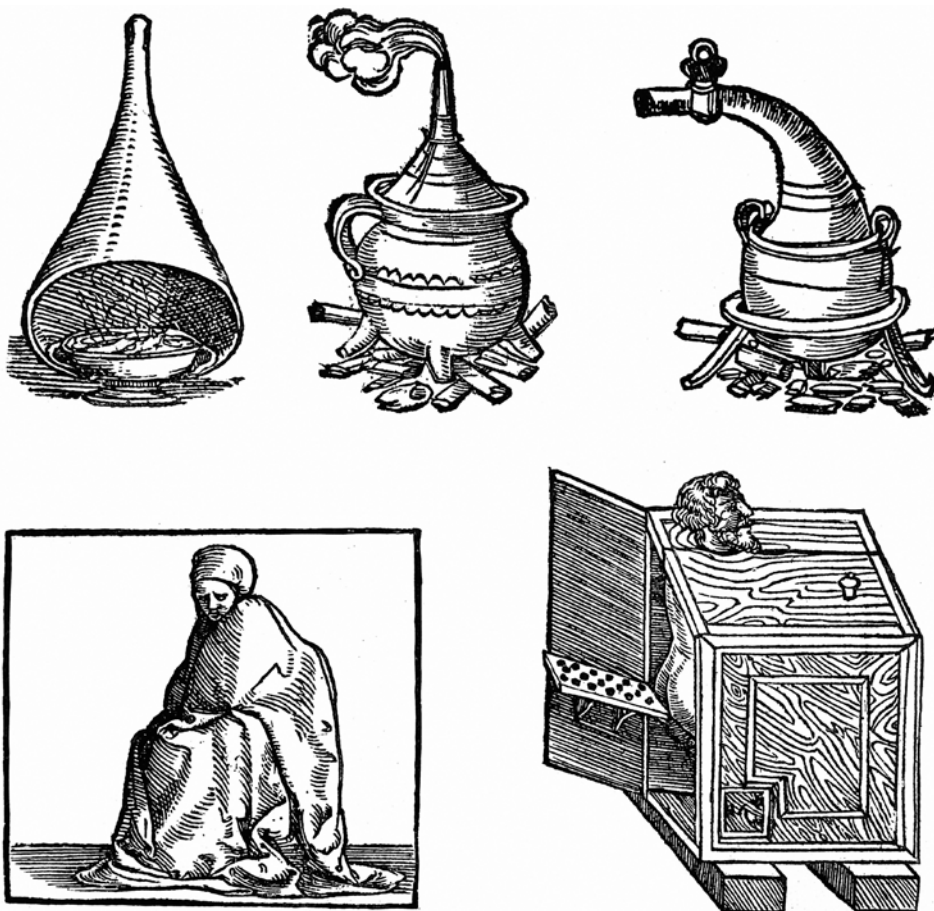


Fig. 7. Jonas Dryander, Vapour baths apparatus. Frankfurt, 1547. Wood engraving.  
Image © Wellcome Library, London.



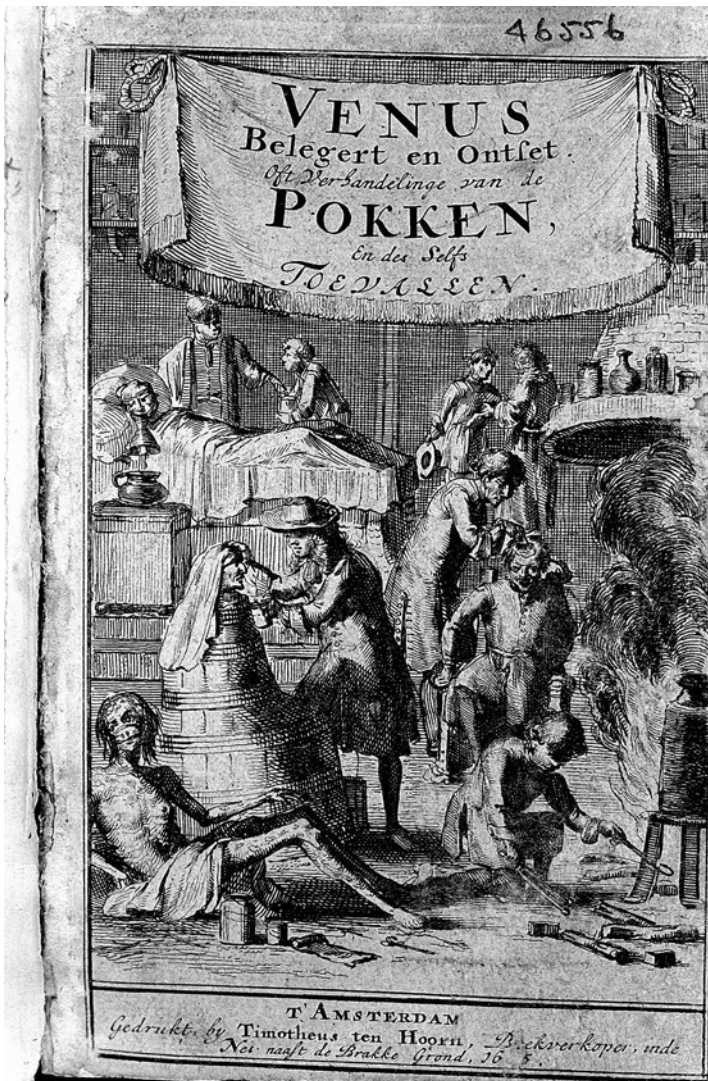


Fig. 8. J. Harrewijn, Sweat treatment to cure syphilis in Steven Blankaart, *Venus belegert en ontset. Oft Verhandelinge van de pokken, en des selfs toevallen, met een grondige en zekere genesinge. Steunende meest op de gronden van Cartesius* (Amsterdam, Timotheus ten Hoorn: 1684), Tab. VI. Copper engraving. Image © Wellcome Library, London.



the parts of the living animal body – membranes, skin, flesh and bones – were full of pores.<sup>74</sup> Boyle further argued, following Hooke, that even the most solid bodies, like glass, metals and stone, are full of pores. In the same way, experimental microscopic findings and observations served as food for thought concerning the anatomical make-up of the skin and its implications for the skin as a passageway for air, sweat and other matter. It had already been observed that the skin served as a place for the excretion of sweat and the existence of insensible perspiration,<sup>75</sup> yet in the light of the attention paid to porosity and microscopy, Boyle wanted to provide experimental proof of the permeability of the skin. By squeezing quicksilver through a piece of human skin from an arm, Boyle at this time experimentally demonstrated the ‘porousness’ of the skin.<sup>76</sup> This interest in the porosity of the skin and the microscopic findings continued to be a subject for discussion into the eighteenth century.<sup>77</sup>

Besides medical dictionaries, other popular sources also referred to the microscopic observation of Leeuwenhoek’s scales and Grew’s pores. In the enormously popular work *The Microscope Made Easy* (1742), for example, Henry Baker (1698–1774) wrote a complete explanation for the amateur of how to find the pores of the skin oneself [Fig. 9].<sup>78</sup> Baker also referred to van Leeuwenhoek’s calculations of the number of pores existing in the body and combined this with the work of the French mathematician Marin Mersenne (1588–1648):

To acquire some clearer Idea still of this prodigious Number of Pores by our Conception of Time; let us reckon with Mersennus, that each Hour consists of sixty Minutes, and each Minute of sixty Seconds, or sixty Pulsations of an Artery: in one Hour there will then be three thousand and six hundred Pulses; in twenty-four Hours eighty-six thousand and four hundred; and in a Year thirty-one Millions five hundred and thirty-six thousand. But there

<sup>74</sup> Boyle, *Experiments* 3. See also the review of this book in *Philosophical Transactions* 14 (1684) 702–703.

<sup>75</sup> Boyle refers in his work to the observations of the Italian physician Santorio Santorio (1561–1636) who in long-term measurements and sensitive weighing of body weight, food intake and excrements revealed the concept of ‘insensible perspiration’. See Santorio Santorio, *Ars de statica medicina, aphorismorum sectionibus septem comprehensa* (Venice, N. Polus: 1614).

<sup>76</sup> Boyle, *Experiments* 11.

<sup>77</sup> Interpretations of skin and skin pores continued to change with the observations and interpretations of new researchers. See for example the famous work by the physiologist Haller Albrecht von, *Dr. Albert Haller’s Physiology. Being a Course of Lectures upon the Visceral Anatomy and Vital Oeconomy of Human Bodies* (London, W. Innys and J. Richardson: 1754), vol. II, 4–5.

<sup>78</sup> Baker Henry, *The Microscope Made Easy* (London, R. Dodsley: 1742) 174.

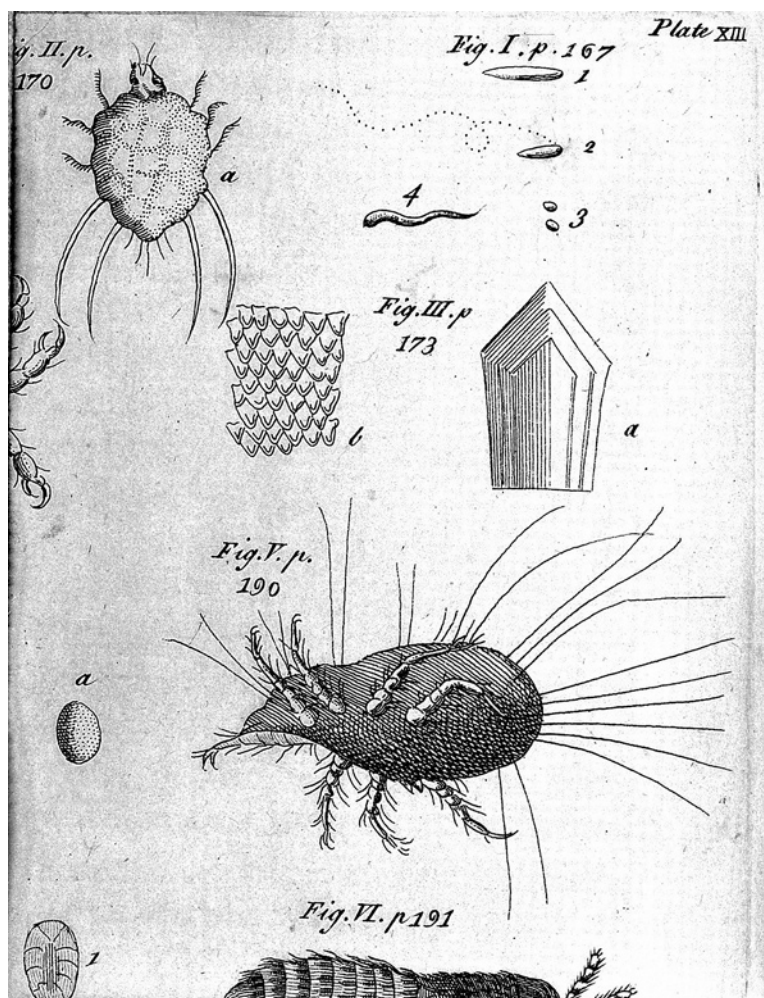


Fig. 9. Scales of the skin reappear in a popular work on microscopy, in Henry Baker, *The Microscope Made Easy* (London, R. Dodsley: 1744), plate XIII, Fig. III. Copper engraving. Image © Wellcome Library, London.

are about sixty-four times as many Pores in the Surface of a Man's Skin, and therefore he must live sixty-four Years, e'er he will have a Pulsation for every Pore in his Skin.<sup>79</sup>

This shows to what extent the microscopic view on the skin became part and parcel of popular microscopic accounts, as well as of medical knowledge. Even more importantly, the microscopic conceptualisation of the skin's pores was fully integrated with the physiological interests of the time, being the pulsations in the living body. The popularity of Baker's work on the microscope is shown by the fact that by 1822 this very same quotation about the pores of the skin appeared in other publications including the popular weekly literary and scientific magazine *The Kaleidoscope*.<sup>80</sup>

I have argued here how the conception of the anatomy and physiology of the skin was reconfigured in late seventeenth-century microscopic investigations. From the ancients' metaphoric understanding of a fisherman's net, the skin was imagined as a scaly microscopic structure, yet still permeated with pores. Microscopists not only provided a natural philosophical explanation for the porosity of the skin; they also shifted the focus from the integrity of the skin for the body to the mechanisms of excretion and absorption. The nature of the passageway and its workings were now elucidated in a microscopic imagination. Yet the integration of these new findings did not by definition result in a complete turnaround in medical concepts of the skin for clinical practice. Since anatomy was the stepping stone for physiological writings, while the explanation changed, the role of the skin in respiration and other body functions did not.

It was not until the nineteenth century that a whole new conception of the skin as an anatomically compound organ with its own functions and physiology emerged in modern medicine and the popular imagination [Fig. 10].<sup>81</sup> Anatomically, however, after the late seventeenth century the skin would never again be viewed as it had been previously: the intimate details of the internal make-up were henceforth always mediated by a new tool – the microscope.

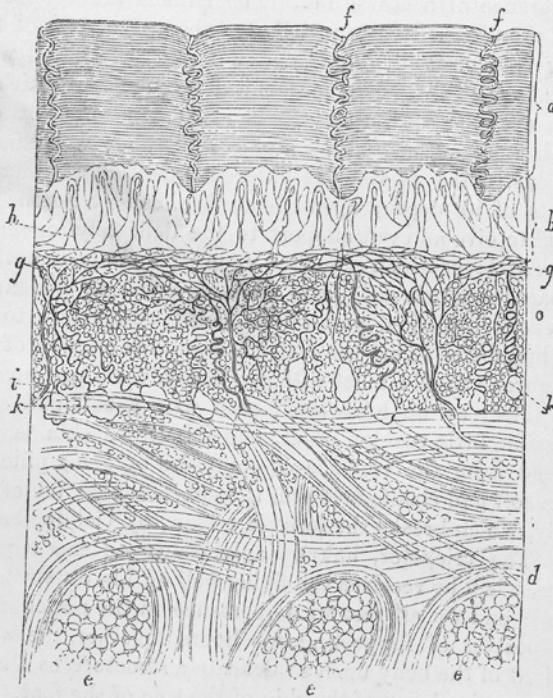
<sup>79</sup> Baker, *Microscope* 174–175.

<sup>80</sup> See *The Kaleidoscope, or Literary and Scientific Mirror* 2 (Liverpool: 1822) 69.

<sup>81</sup> Hennepe M. te, "Depicting Skin: Microscopy and the Visual Articulation of Skin Interior 1820–1850", in Vall R. van de – Zwijnenberg R. (eds.), *The Body Within. Art, Medicine and Visualization* (Leiden: 2009) 51–65.

strength and elasticity, enjoy a contractile power above and apart from their other properties; while a fourth, without strength or elasticity, possess a faculty of independent motion. It is these two latter that produce the

*Fig. 10.\**



\* *Fig. 10.*—A section of the skin of the palm of the hand, the section being made through the middle of one of the ridges, and not across the ridges, as in *fig. 1*. The figure is magnified thirty-eight times.

*a.* The scarf-skin, showing its laminated texture, and four spirally twisted perspiratory tubes which traverse it. *b.* The papillary layer of the sensitive or true skin; three clusters of papillæ are seen.

Fig. 10. Microscopical representation of the skin in a popular hygiene work, in E. Wilson, *Healthy Skin. A Popular Treatise on the Skin and Hair, their Preservation and Management* (London: 1953) Fourth edition, Fig. 10, page 24. Wood engraving. Image © Wellcome Library, London.

*Selective bibliography*

- BAKER HENRY, *The Microscope Made Easy* (London, R. Dodsley: 1742).
- BENTHIEN C., *Skin. On the Cultural Border between Self and the World* (New York: 2002) [tr. Dunlap T.].
- BOYLE ROBERT, *Experiments and Considerations about the Porosity of Bodies* (London, S. Smith: 1684).
- CORNFORD J.M., *Plato's Cosmology. The Timaeus of Plato* (London: 1937).
- CROOKE HELKIAH, *Mikrokosmographia. A Description of the Body of Man, Together with the Controversies and Figures thereto Belonging / Collected and Translated out of All the Best Authors of Anatomy, Especially out of Gasper Bauhinus and Andreas Laurentius, by Helkiah Crooke* (London, W. Iaggard: 1616).
- CUNNINGHAM A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- GREW NEHEMIAH, "The Description and Use of the Pores in the Skin of the Hands and Feet, by the Learned and Ingenious Nehemiah Grew, M.D. Fellow of the College of Physicians and of the Royal Society", *Philosophical Transactions* 14 (1684) 566–567.
- LEEUWENHOEK ANTONI VAN, "An Abstract of a Letter from Mr. Antony Leewenhoeck at Delft, dated Sep. 17, 1683. Containing Some Microscopical Observations, about Animals in the Scurf of the Teeth, the Substance Call'd Worms in the Nose, the Cuticula Consisting of Scales", *Philosophical Transactions* 14 (1684) 568–574.
- MERCURIALE GIROLAMO, *De morbis cutaneis et omnibus corporis humani excrementis tractatus locupletissimi* (Venice, Paulus and Antonius Meietos fratres: 1572).
- RUESTOW E.G., *The Microscope in the Dutch Republic. The Shaping of Discovery* (Cambridge: 2004).
- SUTTON R.L., *Sixteenth Century Physician and his Methods. Mercurialis on Diseases of the Skin. The First Book on the Subject (1572)* (Kansas City: 1986).
- TURNER DANIEL, *De Morbis Cutaneis. A Treatise of Diseases Incident to the Skin* (London, R. Bonwicke: 1714).
- VALL R. VAN DE – ZWIJNENBERG R. (eds.), *The Body Within. Art, Medicine and Visualization* (Leiden: 2009).
- WILSON P.K., *Surgery, Skin and Syphilis. Daniel Turner's London (1667–1741)* (Amsterdam: 1999).
- , "William Cowper's Anatomy of Human Skin", *International Journal of Dermatology* 31 (1992) 361–363.

PART FOUR

TEARS AND SIGHT





## VISION AND VISION DISORDERS. GALEN'S PHYSIOLOGY OF SIGHT

Véronique Boudon-Millot

ὥς ὁψις ἐν ὀφθαλμῷ, νοῦς ἐν ψυχῇ  
'As sight is in the eye, so is the mind in the soul'  
Aristotle, *Topics* 108a11.

### Summary

The aim of this paper is to present the Galenic theory of vision to provide a better understanding of the models according to which Galen represented the phenomenon of vision. Without neglecting the difficulties associated with the coexistence of both the geometric and pneumatic theories of vision, this paper will focus on the study of physiology and the predominant role of *pneuma*. First, I will briefly outline the explanations of the phenomenon of vision given by both predecessors and contemporaries of Galen. I will then explore Galen's attachment to visual *pneuma* and investigate to what extent this can be explained by his debt to Stoic theories. Finally, I will study how, although there is a continual interchange between theory and observation, Galen has committed a certain number of errors which have been transmitted to posterity over a long period of time.

Although Galen showed great interest in the anatomy of the eye and in eye diseases, he paid far less attention to what we call the physiology of vision, if we mean by this the way in which images are formed on the retina in order to reach the brain. Despite the fact that in the *On Affected Parts* – his physiological treatise *par excellence* – Galen carefully tries to distinguish seven different membranes (or layers, χιτῶνας) of the eye,<sup>1</sup> and despite devoting an entire treatise (now lost) to *Diseases of the eyes*,<sup>2</sup> in

---

<sup>1</sup> Galenus, *De usu partium* 10.1–2 (3.759–769 K.).

<sup>2</sup> See Savage-Smith E., "Galen's Lost Ophthalmology and the *Summaria Alexandrinorum*", in Nutton V. (ed.), *The Unknown Galen* (London: 2002) 121–138. As E. Savage-Smith remarked (132), *Diseases of the eyes* (τῶν ἐν ὀφθαλμοῖς παθῶν διάγνωσις), which Galen quotes in *De libris propriis* (*SM* II, 97 = ed. Boudon-Millot V. (Paris: 2007) 140, 18) but is lost in Greek, is Galen's only known treatise devoted exclusively to eyes. However, it seems less certain that the expression ὥς ἐν τοῖς ὀπτικοῖς δέδεικται λόγοις in *De usu part.* 8.6 (3.641.6 K.) should be understood as a clear reference to a treatise on vision (vs. Daremberg Ch., *Œuvres anatomiques, physiologiques et médicales de Galien* (Paris: 1854), vol. 1, 544) which Galen had written but which is now lost. This expression instead refers vaguely to all the

the end he only dedicates very few pages to the phenomenon of sight. Therefore, we need to look elsewhere in the pages he dedicated to pathology, in particular his *On Affected Parts*, for discussions which will enable us to better understand the models according to which Galen represented the phenomenon of vision.<sup>3</sup>

I would add here that, since the present study is dedicated to the physiology of sight, I shall not address in any detail the geometric laws that govern Galen's theory of vision. These have been discussed in an earlier study in which I analysed the optical diagrams which illustrate book X of *On the Use of the Parts*.<sup>4</sup> Moreover, Galen himself admits to having long been reluctant to inflict such a discussion of Euclidean geometry on his reader, who might be discouraged by its difficult nature. In the end it was a dream about Asclepius that persuaded him to inform his reader about the optical laws that can explain why the eyes, although two in number, do not see double, or why we can see both an object and those objects close to it, or why an object seems to change place according to whether we are looking at it with the right eye on its own, with the left eye or with both eyes simultaneously.<sup>5</sup> Without neglecting the difficulties associated with the coexistence of both the geometric and pneumatic theories of vision, I wish to focus in this paper, in line with the theme of this volume, on the study of physiology alone, and the predominant role of *pneuma*.<sup>6</sup>

---

passages where Galen discussed the topic of vision. See also 3.786.1 K. where the same expression is found.

<sup>3</sup> Greek doctors were primarily interested in the diagnosis and treatment of disorders of vision, to the detriment of physiology, which they often neglected. The fragments preserved in the papyri studied by Marganne M.-H., *L'Ophtalmologie dans l'Égypte gréco-romaine d'après les papyrus littéraires grecs* (Leiden: 1994) perfectly illustrate this primarily therapeutic stance, even if they do not completely ignore details concerning the circulation of *pneuma* in the *poroi* (see, for example, Marganne, *L'Ophtalmologie* 71). The same applies to the Pseudo-Galenic treatise *Introductio seu medicus*, in which ch. XVI (Περὶ τῶν ἐν ὀφθαλμοῖς συνισταμένων παθῶν) is totally devoted 'to the diseases which form in the eyes' (14.767–777 K. = ed. Petit C. (Paris: 2009) 77–86), apart from the mention of 'a passage extending from the brain and the meninx to the eye' and which, if broken, causes complete blindness (ἀβλεψίαν τελεῖαν). Such was also the case for the medical papyri from Pharaonic Egypt, studied by Th. Bardinnet, which are mainly devoted to treatment and in which we find the only mention of many types of recipes for ocular treatments (see Bardinnet Th., *Les papyrus médicaux de l'Égypte pharaonique* (Paris: 1995) 178–179).

<sup>4</sup> Boudon-Millot V., "Illustrer les médecins grecs à la Renaissance: Les schémas d'optique galénique", in Boudon-Millot V. – Cobolet G. (eds.), *Lire les médecins grecs à la Renaissance. Aux origines de l'édition médicale* (Paris: 2004) 209–232.

<sup>5</sup> Concerning the solution offered to these problems, see my article quoted in footnote 4, in particular pages 218–223.

<sup>6</sup> On the difficulties in overcoming the contradictions between the *pneumatic* and *geometric* theories and attempts to compromise between them, see in particular Siegel R.E., *Galen on Sense Perception* (Basel-New York: 1970) 94–117.

However, before we tackle the different passages in the Galenic corpus, it will be useful to briefly outline the explanations of the phenomenon of vision given by doctors and philosophers, both predecessors and contemporaries of Galen.

### *Doxography*

While it could be said that philosophers' theories of vision are not always characterised by their clarity, I will endeavour here to make the subject a little clearer.

Book IV of the *Placita Philosophorum* – a treatise ascribed to Plutarch but that actually dates to a doxography of Aëtius, a compiler who wrote at the end of the first or beginning of the second century BC<sup>7</sup> and who displays a very large number of connections with Stobaeus and the Pseudo-Galenic *History of Philosophy* – relates directly to our topic. Dedicated to the soul, book IV begins with some general considerations (chapters 2–7), followed by four chapters (chapters 9–12) concerning the theory of sensation as a whole, then eight further chapters relating to each individual sense (chapters 13–20). Chapter 13, entitled 'On vision, how we see' (Περὶ ὁράσεως, πῶς ὁρῶμεν) merits attention.<sup>8</sup> The phenomenon of viewing is the subject of various explanations, all of which have in common the formation of images (εἰδῶλα), or 'shapes', and the use of rays (ἀκτίνες).<sup>9</sup> A first explanation, attributed to Democritus and Epicurus,<sup>10</sup> explains vision by the penetration into the eye of images projected by perceived objects (κατ'εἰδῶλων εἰσκρισεις) and by the emission of certain rays (κατὰ τινων ἀκτίνων ἔκκρισιν) which, having encountered the perceived object, return

<sup>7</sup> See Pseudo-Plutarchus, *Placita philosophorum* XII<sup>2</sup>, ed. Lachenaud G. (Paris: 1993) 15–18.

<sup>8</sup> See Ps.-Plutarch, *Placita philosophorum* IV, 13, ed. Lachenaud 154 = Diels H., *Doxographi Graeci* 403; Pseudo-Galenus, *Historia philosopha* 19.306–307 K.

<sup>9</sup> As J. Jouanna rightly notes, "Soleil, toi qui vois tout": variations tragiques d'une formule homérique et nouvelle étymologie de ἀκτίς", in Villard L. (ed.), *Études sur la vision dans l'Antiquité classique* (Rouen: 2005) 52 'La vision dès l'époque homérique, suppose l'émission d'un rayon lumineux qui part de l'œil humain ou le soleil, et se porte sur les objets. Ce rayon lumineux est émis à la manière d'une arme de jet'. This leads Jouanna, "Soleil" 55, to suggest the following etymology for ἀκτίς: 'De même que ἄκων est une arme de jet pointue que l'on lance, ἀκτίς est un trait pointu lancé par une source lumineuse, d'abord le soleil, puis la lune, puis la foudre de Zeus ou une lampe dans la nuit. On propose donc de rattacher ἀκτίς au groupe des mots de la famille \*ak- avec élargissement en -t-, comme ἀκτή "la pointe" de terre qui s'avance dans la mer. C'est la notion de "aigu", "pointu", qui est fondamentale'.

<sup>10</sup> To which Stobaeus also adds the name of Leucippus.

to the eye (μετὰ τὴν πρὸς τὸ ὑποκείμενον ἔντασιν πάλιν ὑποστραφουσὼν πρὸς τὴν ὄψιν).<sup>11</sup> A second explanation, attributed to Empedocles,<sup>12</sup> supposes 'a mixture of images and rays' (Ἐμπεδοκλῆς τοῖς εἰδώλοις τὰς ἀκτῖνας ἀνέμιξε) in a method which is not clarified any further.<sup>13</sup> According to the Pythagorean philosopher Hipparchus, 'rays are projected from both eyes and come into contact at their extremity with the external bodies, just like hands coming into contact'.<sup>14</sup> Finally, according to Plato, 'there is convergence of two light rays: one from the eyes is diffused into the air after a certain distance because it shares the same property; the other, coming from the external bodies, causes tension in the fluidic and malleable air

<sup>11</sup> However, Lachenaud G., *Placita philosophorum* 290–291, notes that the present passage suggests rays emitted from the eye leaving and coming back, which seems incompatible with what else we know about Democritus' theory of vision, in particular Theophrastus' testimony (*De causis plantarum* VI, 2, 3 = A 130; idem, *De sensu* 49–83 and above all 50–54 = 68A 135 DK) which reads: 'Seeing is produced (ὁρᾶν μὲν οὖν ποιεῖ), according to him (sc. Democritus), by the reflected image (τῇ ἐμφάσει). He explains it in his own way, since the image (τὴν γὰρ ἔμφασιν) is not produced immediately in the pupil (οὐκ εὐθὺς ἐν τῇ κόρῃ γίνεσθαι), but rather the air situated in the space between the viewer and the perceived object is compressed and impacted by the visible object and the seeing eye, since every single thing emits some kind of flow (ἀπορροήν)'. Thus, vision appears as the result of a complex phenomenon produced by the meeting of flows generated by the perceived object and the viewer, and the reflection of this combination in the eye. Aristotle, although simplifying Democritus' theory, also attributes to him the opinion that vision is a mirror image formed by reflection (*Sens.* 438 a: ἀνάκλασις). Thus, rather than the rays going back and forth between the eye and the perceived object, G. Lachenaud suggests that it is a matter of the interaction between the rays emitted by the perceived object and those emitted by the viewer. However, I would add that the Pseudo-Galenic *Historia philosopha* (19.306.16 K.) distinguishes between the theory of the penetration of images (κατ' εἰδώλων εἰσκρισιν) attributed to Democritus and Epicurus, and the theory of the emission of rays (κατ' ἀκτίνων ἔκχυσιν), attributed to others (ἕτεροι), without being any more precise. Thus, we are dealing with two different theories of vision, and only the first one is attributed to both Democritus and Epicurus.

<sup>12</sup> However, Diels H., *Doxographi* 403, following Stobaeus, attributed this theory to Histiaeus of Perinthus.

<sup>13</sup> Bollack J., *Empédocle*, vol. 3, 2 (Paris: 1965–1969) 365, believes in particular that visual rays stop short at the surface of the eye and that the flows play a crucial role. Aristoteles, *De sensu* 437b26–35 notes that 'Empedocles sometimes seems to think that man can see because of light coming out of the eye', as from a lantern, but he also sometimes explains vision by emanations generated by the perceived objects.

<sup>14</sup> Ἰππαρχος ἀκτῖνάς φησιν ἀφ' ἑκατέρου τῶν ὀφθαλμῶν ἀποτεινομένας τοῖς πέρασιν αὐτῶν οἷον χειρῶν ἐπαφαῖς περικαθαπτούσας τοῖς ἐκτὸς σώμασι τὴν ἀντιληψὶν αὐτῶν πρὸς τὸ ὁρατικὸν ἀποδίδοναι. On the Pythagorean theory of vision, see Haas A., *Antike Lichttheorien. Archiv für Geschichte der Philosophie*, vol. 20, Heft 3 (Berlin: 1907) 353–362, who quotes Diogenes Laertius, *De clarorum philosophorum vitis* 8.29 and Aëtius, *Placita* 4.13. Haas remarks that Empedocles, Alcmaeon, Plato and the Stoics share with Pythagoras the idea of 'vision rays'.

in-between, at the same time as the fire from the eyes. This is what is meant by Plato's light convergence (Πλατωνική συναύγεια).

The theory of light convergence reported by Pseudo-Galen can be compared to a passage in Plato's *Timaeus*, where Plato discussed his theory of vision, although there the term συναύγεια does not appear. Indeed, Plato supposes the existence of a pure fire (πῦρ εἰλικρινές) contained within the body and which flows smoothly and continuously through the eyes (διὰ τῶν ὁμμάτων ρεῖν λεῖον καὶ πυκνὸν ὄλον). Thus, in order to see, the eye needs daylight to surround the flux which flows within it (ὅταν οὖν μεσημερινὸν ᾗ φῶς περὶ τὸ τῆς ὀψέως ῥέυμα). Since both daylight and the visual stream are similar in their properties, they merge into a single entity to form a homogeneous body in the visual axis of the eye which, after the encounter and impact caused by the projection from external objects, 'then transmits the movements through the whole body, up to the soul, and provides us with that sensation thanks to which we say that we can see' (τούτων τὰς κινήσεις διαδίδον εἰς ἅπαν τὸ σῶμα μέχρι τῆς ψυχῆς αἴσθησιν παρέσχετο ταύτην ἥ δὴ ὁρᾶν φαμεν).<sup>15</sup>

Aristotle is notably absent from the doxography of Pseudo-Plutarch's *Placita philosophorum*, whose theories, especially those discussed in his *On the Soul*, remain curiously ignored. Nevertheless, Aristotle occupies an original position in his assertion that 'it is absurd to claim that vision is exerted thanks to something coming out of the eye'.<sup>16</sup> Indeed, Aristotle rejects the Platonic opinion that vision is formed from fire and that the eye is an organ from which light is emitted as if out of a lantern.<sup>17</sup> He asserts, on the contrary, that 'it is colour which is visible' (ὁρατὸν δ' ἐστὶ χρώμα), defined as a superficial coating of visible objects that is able to stir transparent objects into movement (κίνητικόν ἐστι τοῦ κατ' ἐνέργειαν διαφανοῦς), i.e. the object we can see (air, water or numerous solid bodies).<sup>18</sup> Put another way, and as Aristotle himself concludes, 'colour sets the transparent into motion, for example the air, and the latter in turn sets into motion the sensory organ with which it is in contact' (ἀλλὰ τὸ μὴν χρώμα κινεῖ τὸ διαφανές, οἷον τὸ ἀέρα, ὑπὸ τούτου δὴ συνέχους ὄντος κινεῖται τὸ αἰσθητήριον). Thus, sense is produced following the stimulation of an organ, in this instance, the eye (πάσχοντος γάρ τι τοῦ αἰσθητηρίου

<sup>15</sup> Plato, *Timaeus* 45b–d.

<sup>16</sup> Arist. *Sens.* 438a.

<sup>17</sup> Arist. *Sens.* 437b.

<sup>18</sup> Arist. *De anima* 418a–b.

γίνεται το ὄρᾶν).<sup>19</sup> But this is not sufficient and Aristotle goes further in asserting, in his *On Sense and the Sensible*, that ‘vision is not in the eye, but in the person that sees’. By this he means that vision (like any sense) cannot be reduced to a purely physical phenomenon and is primarily a matter of the soul.

These different theories, a combination of philosophy and physiology, have in common the idea that something is emitted by the eye during the viewing process, even if they differ as to the nature of what is actually emitted: fire, or rays. However, Aristotle is an exception, and doctors after him, especially during the Renaissance when there was great debate on the *modus visionis*, readily contrasted the Galenic theory of emission, which concerns *pneuma* (spirit) or rays (ἄκτίνες), with the Aristotelian theory of intromission.<sup>20</sup>

### *The Galenic theory of vision*

We return now to Galen, or rather to the Pseudo-Galenic *Medical Definitions*, a treatise which J. Kollesch has shown not to be authentic, but which had close links with the Galenic corpus, being written around the same time.<sup>21</sup> Definition 117, devoted to the topic which concerns us here, distinguished between sight (ὄψις) as the power (δύναμις) of a translucent (φανώδης, a hapax) and air-like substance (οὐσίας ἀερώδους), and vision (ὄρασις), which is in motion (ἐνεργητική) and which is produced through the eyes due to the lightly-flowing *pneuma*, which is particularly present in the pupil area, thanks to which visual perceptions occur.<sup>22</sup> The origins of this ‘pneumatic’ theory are ancient.<sup>23</sup> It was destined to achieve great

<sup>19</sup> Arist. *De An.* 419a.

<sup>20</sup> On this point, see the very well-informed paper by Katrien Vanagt 575 in this volume which shows that the Galenic emission theory, widely supported by doctors such as the Italians Girolamo Capivaccio (1523–1589) and Casserius Placentinus (1561–1616), or the Dutchman Johannes Heurnius (1543–1601), was already questioned by Hieronymus Fabricius ab Aquapendente (1537–1619), before being displaced by the experiments of Plempius (1601–1671) and his *camera obscura*.

<sup>21</sup> Kollesch J., *Untersuchungen zu den Pseudogalenischen Definitiones Medicae. Schriften zur Geschichte und Kultur der Antike* 7 (Berlin: 1973).

<sup>22</sup> Pseudo-Galenus, *Definitiones medicae* 117 (19.379, 10–14 K.): “Ὁρασις ἐστὶν ἡ γινομένη διὰ τῶν ὀφθαλμῶν τῷ συγκεκριμένῳ ἐν αὐτοῖς πνεύματι λεπτῷ μάλιστα κατὰ τὸν τῆς κόρης τόπον τυγχάνοντι, δι’ οὗ αἱ ὀρατικαὶ ἀντιλήψεις γίνονται. See the commentary by Kollesch, *Untersuchungen* 104–113.

<sup>23</sup> See Wellmann M., *Die pneumatische Schule bis auf Archigenes in ihrer Entwicklung dargestellt, Philologische Untersuchungen* 14 (Berlin: 1895) 142; Jäger W., “Das Pneuma in

success, and was not completely supplanted by Herophilus' important anatomical discovery in the third century BC of the optic nerves, which he identified as sensory nerves whilst still continuing to call them by the ancient name of πόροι.<sup>24</sup> Galen himself, almost five centuries later, in his *On the Doctrines of Hippocrates and Plato*, while acknowledging the existence of these *poroi*, further explains the mechanism of vision on the basis of the pneumatic theory, even if, as we will see, he is undecided about the nature and the exact role of *pneuma*.

In book VII (chapter 4) of this work, Galen presents a relatively complex explanation to account for the phenomenon of vision. Galen shows that he thinks *pneuma* to be extremely important, and defines it as a 'useful beginning for the senses and the movements of body parts' (καὶ διὰ τοῦτο ἔφαμεν αὐτὸ χρήσιμον ὑπάρχειν εἰς τὰς τῶν μορίων αἰσθήσεις τε καὶ κινήσεις).<sup>25</sup> Although he readily admits the existence and usefulness of *pneuma*, which circulates from the brain to the nerves, its exact nature is left open to debate. In particular, Galen questions whether there exists a *pneuma* that originates from and remains in the nerves or, his second hypothesis, whether the *pneuma* flows to the nerves from the brain, but only when we are feeling or moving. A third hypothesis even goes so far as to negate the existence of *pneuma* by claiming the existence of 'a qualitative change of the continuous parts' (ἢ κατὰ ποιότητα συνεχῶν ἀλλοίωσις) that extend from the brain to other parts of the body, i.e. change that occurs in the parts of the body without involving any substance, a little like the light of the sun, which is able to alter the surrounding air whilst the substance of the sun remains intact and in the same place. However, Galen admits the impossibility of choosing between these three hypotheses and modes of transmission, and on this subject refers to his lost treatise *On Demonstration*, where he had already discussed them. Nevertheless, the question is important because, Galen concludes, 'it is something like that (i.e. something akin to these three hypotheses) which takes place during visual perception' (τοιοῦτον γοῦν τι καὶ κατὰ τὴν ὀπτικὴν αἴσθησιν). But nothing else is

---

Lykeion", *Hermes* 48 (1913) 29–74; Verbeke G., *L'évolution de la doctrine du pneuma du stoïcisme à Saint Augustin* (Paris-Louvain: 1945) 193; and Kudlien F., "Die Pneuma Bewegung. Ein Beitrag zum Themen 'Medizin und Stoa'", *Gesnerus* 31 (1974) 86–98.

<sup>24</sup> See Staden H. von, *Herophilus. The Art of Medicine in Early Alexandria* (Cambridge: 1989) 205–206 and 238–239. According to Theophrastus' testimony (*Sens.* 26 = Diels H., *Doxographi Graeci* (Berlin: 1879) 506–507), Alcmaeon of Croton (late fourth century) was the first to suspect the existence of such intermediate passages (πόροι) between the sensory organs and the brain, considered to be the central organ.

<sup>25</sup> Galenus, *De placitis Hippocratis et Platonis* 7.4 (448, 6 de Lacy; 5.611 K.).



revealed on the subject except that, in the case of the optic nerves, a movement of light *pneuma* is also produced (ἐπ'ἐκείνων τῶν νεύρων αὐγοειδὲς φέρεται πνεῦμα). In reality, Galen's attachment to the pneumatic theory is certainly associated with the observation of the optic nerves, described as 'hollow'. Galen declares that observations derived from anatomy teach that these nerves exhibit 'clearly visible perforations both at their upper ends and at their connections with the eyes' (τρήματα ἐχόντων σαφὴ κατὰ τε τὴν ἄνωθεν ἀρχὴν καὶ εἰς τοὺς ὀφθαλμοὺς ἔμφυσιν), which suggests that something circulates within them.<sup>26</sup>

But Galen's attachment to visual *pneuma* can also be explained by his debt to Stoic theories, particularly those of Chrysippus, who affirms the existence of both such a *pneuma* and rays emitted by the eye.<sup>27</sup> However, Galen does not agree with Chrysippus on the last point, since in a passage of *On Demonstration* (lost in Greek but preserved in Arabic) he considers the existence of such rays emitted from the eye to be impossible.<sup>28</sup> It should be pointed out that Galen, even in the passage of *On the Use of the Parts* where he discusses complex optical laws using notions inherited from Euclidian geometry, carefully avoids talking about 'rays' and prefers simple 'straight lines' (κατ'εὐθείας γραμμάς) plotted between the eye and the perceived object.<sup>29</sup> However, the way in which Galen endeavours to reconcile this geometrical conception of vision with his pneumatic theory is far from clear.<sup>30</sup>

<sup>26</sup> Galen, *De plac. Hipp. et Plat.* 7.4 (448, 26–28 de Lacy; 5.612 K.).

<sup>27</sup> Aët. 4.15.3 (= Pseudo-Plutarch 901D12–E6; SVF II 233 n° 866) Χρύσιππος κατὰ τὴν συνέντασιν τοῦ μεταξὺ ἀέρος ὁρᾶν ἡμᾶς, νυγέντος μὲν ὑπὸ τοῦ ὁρατικοῦ πνεύματος, ὅπερ ἀπὸ τοῦ ἡγεμονικοῦ μέχρι τῆς κόρης διήκει, κατὰ δὲ τὴν πρὸς τὸν περιεκείμενον ἀέρα ἐπιβολὴν ἐντείνοντας αὐτὸν κωνοειδῶς, ὅταν ᾗ ὁμογενὴς ὁ ἀήρ. Προχέονται δὲ ἐκ τῆς ὀψέως ἀκτῖνες πύρινοι, οὐχὶ μέλαιναί καὶ ὀμιχλώδεις· διόπερ ὁρατὸν εἶναι τὸ σκότος. 'Chrysippus says that we are able to see due to the tension of the intermediary air when it is hit by the visual *pneuma*, which spreads from its origin towards the pupil and which, when the surrounding air shares the same nature, usually gives it a canonical shape when it encounters it; fiery rays are projected during vision, not dark or hazy ones. Thus, darkness becomes visible'.

<sup>28</sup> See Strohmaier G., "Bekannte und unbekannte Zitate in den *Zweifeln an Galen des Rhazes*", in Fischer K.-D. – Nickel D. – Potter P. (eds.), *Text and Traditio. Studies in Ancient Medicine and its Transmission presented to Jutta Kollesch* (Leiden-Boston-Cologne: 1998) 272: "Die Reder dessen, der behauptet, dass vom Auge Strahlen ausgehen, bis sie zu dem Gesehenen gelangen, ist eine Unmöglichkeit, weil sich die Strahlen nicht bis zu den Sternen ausdehnen können. Vielmehr wäre es besser zu sagen, dass die Gestalt der Sterne und der gesehenen Objekte mit dem Gesichtssinn durch die Vermittlung des Leuchtenden verbunden ist".

<sup>29</sup> Galen, *De usu part.* 10.12 (3.817.7–8 K.).

<sup>30</sup> On this, see Siegel, *Galen on Sense Perception* 94–117 and my article (quoted n. 4), "Illustrer les médecins grecs à la Renaissance" 209–232.

At the risk of simplifying a particularly complex theory, this mechanism of vision can be summarised by the suggestion that the encounter of πνεῦμα, originating from the brain and carried by the optic nerves, with the surrounding air produces an impact which brings about the formation of images in the crystalline lens, considered by Galen as the principal organ of vision.<sup>31</sup> The retina also plays an important role in Galen, who differs here from his predecessors by considering it not as a true layer, but as a growth and an extension of the brain: 'if you removed it and collected it into a ball, you would believe you saw a piece of detached brain'.<sup>32</sup> This part of the brain that connects with the eyes is then interconnected with the pupil, through where the *pneuma* passes.<sup>33</sup> The problem is that all of this rests in large part on a theory that is naturally impossible to prove. Indeed, Galen bemoans the fact that *pneuma*, being very thin and very light (λεπτότερόν τε καὶ κουφότερον), easily escapes before a dissection can be started. Therefore, in contrast to the aqueous humour situated between the crystalline lens and the uvea, it cannot be observed.<sup>34</sup> Thus, Galen finds himself confronted with the difficulty of accounting for a reality that is, by its very nature, unobservable.

### *Reasoning and experience*

Thus, in this continual interchange between theory and observation, the different anatomical and physiological information collected by Galen aims to confirm the existence of the circulation of *pneuma*. These observations, presented with all the necessary oratorical flourishes, are intended to elaborate a theory of vision which, if not absolutely certain, is at least perfectly plausible. Moreover, Galen describes what happens when we see: according to him, it is likely (εἰκός) that the *pneuma*, having arrived at the eyes and following its first impact with the surrounding air, merges

<sup>31</sup> Galen, *De usu part.* 3.6 (3.760 K.): τὸ κρυσταλλοειδὲς ὑγρὸν τὸ πρῶτόν ἐστιν ὄργανον τῆς ὄψεως.

<sup>32</sup> Galen, *De usu part.* 10.2 (3.762.7 K.): σαφῶς ἂν δόξαις ἐγκεφάλου τι μέρος ἀφηρημένον ὄρῃν. Thus, the retina, as an outer extension of the brain, is attached to the crystalline lens and can usefully signal the sensations felt by it to the brain.

<sup>33</sup> Galen, *De usu part.* 8.6 (3.644.2–3 K.): κατὰ δὲ τὴν κόρην συμφυῆς ἐστὶν ἡ ἐν ὀφθαλμοῖς ἐγκεφάλου μοῖρα (the part of the brain that connects with the eyes is attached to the pupil).

<sup>34</sup> Galen, *De usu part.* 10.5 (3.783.15–16 K.): ἀλλὰ καὶ τὸ μὲν ὥς ἂν λεπτότερόν τε καὶ κουφότερον ῥαδίως ἐκκενοῦται πρὸ τῆς διαιρέσεως.

with it and alters it according to its own particular nature, without being extended over a great distance.<sup>35</sup> From this point of view, the surrounding air plays the same instrumental role between the eye and the perceived object as the optic nerves do between the brain and the eyes; it appears as a kind of prolongation, to the extent, as Galen readily writes in the *On the Doctrines of Hippocrates and Plato*, that the eye is to the air what the brain is to the nerves.<sup>36</sup> Indeed, if we try to understand how we see, only two hypotheses are possible: either the perceived object emits something towards us, or it does not.<sup>37</sup> To distinguish between these two hypotheses, Galen, faithful to his method, resorts once more to anatomy and physiology: since we see through the hole of the pupil (διὰ τοῦ κατὰ τὴν κόρην τρήματος), if objects did emit something towards the pupil's direction, it would be impossible for a very large image (for example, that of a high mountain) to enter the pupil, and it is just as inconceivable that such an image could simultaneously reach a very large number of people, although a mountain can obviously be seen by many people at the same time. Thus, the only solution remaining (λείπεται οὖν ἔτι) is to assume that, when we see, the surrounding air serves as an instrument in the same manner as the nerve which is permanently in our body.

Without going into the details of a highly subtle theory and particularly complex optical laws, I shall simply remark here that the effect produced by the *pneuma* on the surrounding air when encountering it produces a continuum (συνεχοῦς), which enables even remote objects to be perceived.<sup>38</sup> The conclusion, which is true for all sensory organs, is that all the sensory abilities originating from the brain share their conveyance by nerves to their appropriate sensory organs (διὰ τῶν νεύρων ἄχρι τῶν οἰκείων ὀργάνων). However, the optic nerve is the noblest of all nerves because its substance is close to that of the brain (ὁμοειδὲς δὲ καὶ κατὰ τὴν οὐσίαν τὸ νεῦρον ὑπάρχον τῷ ἐγκεφάλῳ), because it has a visible hole, because it is

<sup>35</sup> Galen, *De plac. Hipp. et Plat.* 7.4 (452, 25–28 de Lacy; 5.617 K.): οὕτως γοῦν εἰκός ἐστι καὶ τὸ παραγιγνόμενον εἰς ὀφθαλμοὺς πνεῦμα κατὰ μὲν τὴν πρῶτην ἔμπτωσιν ἐνοῦσθαι τε τῷ περιέχοντι καὶ συναλλοιοῦν αὐτὸ πρὸς τὴν ιδιότητα τῆς ἐαυτοῦ φύσεως, οὐ μὴν ἐπὶ πλείστον γ' ἐκτείνεσθαι.

<sup>36</sup> Galen, *De plac. Hipp. et Plat.* 7.5 (460, 2–4 de Lacy; 5.625 K.): καὶ γίγνεται δὲ τοιοῦτον ὄργανον αὐτῷ πρὸς τὴν τῶν αἰσθητῶν οἰκείαν διάγνωσιν οἷον ἐγκεφάλῳ τὸ νεῦρον, ὥσθ' ὃν ἔχει λόγον ἐγκέφαλος πρὸς τὸ νεῦρον, τοιοῦτον ὀφθαλμὸς ἔχει πρὸς τὸν ἀέρα.

<sup>37</sup> Galen, *De plac. Hipp. et Plat.* 7.5 (452, 29–33 de Lacy; 5.618 K.).

<sup>38</sup> This phenomenon is particularly significant for colour perception; see Boudon-Millot V., "La théorie galénique de la vision: couleurs du corps et couleurs des humeurs", in Villard L. (ed.), *Couleurs et vision dans l'Antiquité classique* (Rouen: 2002) 65–75, particularly 71–74.

both soft and long, because once in the eye it is unattached, and because it is very similar to the brain.<sup>39</sup> Moreover, since it is an intermediary between the brain and the eye, the optic nerve is peculiar in being softer inside (since it is drilled and hollow in its centre) and harder on the outside (to ensure the safe passage of the *pneuma*).<sup>40</sup>

It is important to highlight that this theory of vision is presented by Galen not as being certain, but only as probable (εικότως).<sup>41</sup> It is thus not surprising that Galen never stopped wishing to prove it to be true, tirelessly trying to demonstrate this whilst treating numerous disorders of vision, of different levels of severity, throughout his medical career.<sup>42</sup> When Galen acts as a doctor rather than a theorist, it is to gather as much evidence as possible to prove a mechanism of vision that, as a theorist, he had only been able to present as probable.

*Testing the facts. The theory of vision and pathology of sight*

Typically for Galen, his interpretations risk being seriously distorted by his theory, which is supported by anatomical and physiological data. He aims to prove that *pneuma* circulates through the *poroi* to the eyes (φέρεται τι πνεῦμα διὰ τῶν πόρων τούτων ἐπὶ τοὺς ὀφθαλμούς);<sup>43</sup> the proof, according to Galen, is that when one eye is closed, the pupil of the other eye dilates (εὐρύνεσθαι θατέρου τὴν κόρην) under the flow of *pneuma*, and when the eye is opened again, the pupil of the other eye resumes its normal size at once (παραχρῆμα πάλιν εἰς τὸ κατὰ φύσιν ἐπανέρχεσθαι μέγεθος). Moreover, the rapidity of dilatation and contraction is a sign that the circulating *pneuma* cannot be a fluid (οὐχ ὑγροῦ τινος ἐπιρρέοντος), but only an air-like

<sup>39</sup> Galen, *De plac. Hipp. et Plat.* 7.5 (456, 21–25 de Lacy; 5.622 K.).

<sup>40</sup> The optic nerve is also softer inside to preserve as much as possible the nature of the brain with which it connects; see Galen, *De plac. Hipp. et Plat.* 7.5 (456, 25–28 de Lacy; 5.622 K.).

<sup>41</sup> Galen generally uses cautious expressions when talking about vision: ἐγὼ μὲν οὐκ ἔχω προχείρως ἀποφύνασθαι (*De plac. Hipp. et Plat.* 7.4 (448, 11 de Lacy; 5.611 K.); οὐκ οὐδὲν τε προχείρως ἀποφύνασθαι πότερον (448, 19–20); εικότως (450, 30); εικός ἐστι (452, 25); τοιοῦτον γάρ τι πάσχειν ἔοικεν (454, 10); φαίνεται γοῦν ὁμοίον τι πάθος συμβαίνειν (454, 23); εικότως δ' ὡς ἔφην (460, 1).

<sup>42</sup> According to Magnus H., *Die Augenheilkunde der Alten* (Breslau: 1901) 606–608, Galen supposedly performed some forty different eye operations relating to the eyelids, the conjunctiva, the cornea, the crystalline lens or the tear ducts.

<sup>43</sup> Galen, *De plac. Hipp. et Plat.* 7.4 (450, 10–11 de Lacy; 5.614 K.).

substance (ἀλλὰ μόνῃς πνευματικῆς οὐσίας).<sup>44</sup> In such a case, experience and observation are indispensable for supporting the reasoning since, as Galen declares, ‘reasoning (τῷ λόγῳ) does not prove on its own that the pupil is dilated by *pneuma*, but it is still possible to demonstrate it experimentally (δι’ ἐπιτεχνήσεως) and to verify the reasoning using obvious facts’.<sup>45</sup>

From this point of view, Galen uses cases of people suffering from cataracts (τὸ τῶν ὑποκεχυμένων) in *On the Doctrines of Hippocrates and Plato* to provide some of his favourite examples, allowing him to clarify his theory of vision. Indeed, although Galen was probably wrong about the disease and the surgery it required,<sup>46</sup> cataracts (ὕπόχυμα)<sup>47</sup> are used on several occasions as a model to explain and illustrate his theory of vision. In this disease, patients maintain their visual ability if the hole of the pupil (τὸ τρήμα)<sup>48</sup> in the healthy eye is sufficiently dilated to allow the additional *pneuma* to pass through; but those in whom such dilatation does not occur lose their visual ability completely and, even if the cataract is removed entirely (κἀν καλῶς κατὰχθῃ τὸ ὑπόχυμα), are unable to see. Thus, Galen understands this to be an irreversible process, whose origin, not explicitly stated but nevertheless strongly implied, lies in the creation of too much *pneuma* where both optic nerves converge and meet,<sup>49</sup> leading

<sup>44</sup> Galen, *De plac. Hipp. et Plat.* 7.4 (450, 17–18 de Lacy; 5.614 K.). Many similar examples can also be found in *De usu part.* 10.5 (3.781 K.). See also the *De sympt. caus.* 1.2 (7.89 K.: Johnston I., *Galen on Diseases and Symptoms* (Cambridge: 2006) 207), which provides exactly parallel observations on the pathological dilatation of the pupil.

<sup>45</sup> Galen, *De usu part.* 10.5 (3.782.13–16 K.).

<sup>46</sup> According to Daremberg Ch., *Œuvres [...] de Galien* (Paris: 1854), vol. I, 608 n. 1.

<sup>47</sup> Amongst Greek doctors, cataracts (ὕπόχυμα, from ὑποχέω “to pour under, into something”) is not clearly distinguished from glaucoma (γλαύκωμα), since both designate quite similar complaints, although glaucoma refers to incurable afflictions; see Marganne M.-H., “Glaucome ou cataracte? Sur l’emploi des dérivés de γλαυκός en ophtalmologie antique”, *History and Philosophy of the Life Sciences* 1 (1979) 199–214. We should also distinguish cataracts from other afflictions that form white spots on the eye, which in Latin are called *albuginae*; see Grmek M., “*Albugine oculorum*: cataracte ou taies de la cornée?”, in Deroux C. (ed.), *Maladie et maladies dans les textes latins antiques et médiévaux* (Brussels: 1998) 422–433. The Stoic philosopher Chrysippus (*SVF* II 52 n. 178 = Simplicius, *In Aristotelis Categoriae Commentarium* 12b26, 401, l. 40–42 Kalbfleisch) was the first to mention cataract surgery in the third century BC, a practice described in detail by Celsus in Tiberius’ time (*De medicina* 7.7.14a). Galen mentions cataract surgery in his *De methodo medendi* 14.3 (10.986–989 K.).

<sup>48</sup> The Greek reads here τὸ τρήμα for τὸ κατὰ τὴν κόρη τρήμα, on the model of τὸ κατὰ τὴν κόρη τρήματι (Galen, *De plac. Hipp. et Plat.* 7.4 (450, 15 de Lacy; 5.614 K.)).

<sup>49</sup> On the optic chiasm, an anatomical system of optic nerves that Galen describes well, see *De usu part.* 10.12 (3.813–814 K.) and the commentary of Marganne, *L’Ophtalmologie* 73–77. Galen understood the optic chiasm to be a meeting and union of two optic nerves which come together and communicate before separating again, but without actually crossing.

in turn to the obstruction of the optic nerve channels (ἐμπεφράχθαι τοὺς πόρους τῶν ὀπτικῶν νεύρων) and then to a total loss of sight.<sup>50</sup> This loss is generally progressive, as in the case of a patient who, at the start, could see a 'great light in front of his eyes' when he opened them wide in the dark (a fairly common phenomenon, which Galen himself said he experienced), but which slowly decreased (κατὰ βραχὺ μειωθῆναι) before disappearing completely, leading firstly to a weakening, and then complete loss, of vision (καὶ τὴν ὀπτικὴν αἴσθησιν ἀμαρουμένην ὁμοίως εἰς ἀπώλειαν ἀφικέσθαι παντελῆ).<sup>51</sup>

Galen, in the *On the Use of the Parts*, again uses cataracts as an example, this time to demonstrate that the crystalline lens is the principal organ of vision (ὥς αὐτὸ τὸ κρυσταλλοειδὲς ὑγρὸν τὸ πρῶτόν ἐστιν ὄργανον τῆς ὄψεως). His notion that the crystalline lens is the place where visual images are formed is a clear error, and one that is often pointed out,<sup>52</sup> but this does not prevent him from claiming that: 'What clearly proves it is the effect produced by what doctors call suffusions (cataracts, ὑπόχυματα), when they appear between the crystalline lens and the cornea (μέσα μὲν ἰστάμενα τοῦ κρυσταλλοειδοῦς ὑγροῦ καὶ τοῦ κερατοειδοῦς χιτῶνος) and prevent vision (ἐμποδίζοντα δὲ τὰς ὄψεις), until broken up by paracentesis (ἄχρι περ ἂν τύχη παρακεντηθέντα).'<sup>53</sup>

A little later in the same treatise, Galen again endeavours to demonstrate that the pupil's cavity is filled with *pneuma* by conducting various experiments.<sup>54</sup> Thus, he observes that in living beings, the eye is perfectly stretched and full in all its parts but, in dead people, the eye is already more wrinkled than in its natural state, even before dissection. Indeed, we saw above that Galen thought that the *pneuma* escapes before it could be observed. Similarly, Galen here repeats the following observation about which he seems to be adamant: 'if we close one eye and keep the other open, we see that the pupil is enlarged, dilated and somewhat swollen', a further sign of the flow of *pneuma* into the single open eye. Similarly, in elderly people, the cornea becomes wrinkled to the extent that some

<sup>50</sup> This concerns a hypothesis formulated by numerous eminent doctors, which Galen himself considers as probable (εἰκότως).

<sup>51</sup> Galen, *De plac. Hipp. et Plat.* 7.4 (450, 31–36 de Lacy; 5.615 K.).

<sup>52</sup> Ch. Daremberg, in his translation of the passage (*Œuvres [...] de Galien* (vol. 1, 608) adds in a footnote that 'Galien regarde à tort le cristallin comme l'organe essentiel de la vue, puisque la vue peut être à peu près complètement rétablie après l'abaissement ou l'extraction du cristallin dans l'opération de la cataracte'.

<sup>53</sup> Galen, *De usu part.* 10.1 (3.760, 14–761, 1 K.).

<sup>54</sup> Galen, *De usu part.* 10.5 (3.781 K.).



lose their sight completely, and others see poorly and hardly at all. This is because the *pneuma*, which becomes increasingly sparse with age, is disturbed by the accumulation of these wrinkles, which lie on top of each other and form outside the pupil. Thus, all these observations help to show that the cavity of the pupil is filled with *pneuma* (ὅτι πνεύματος πλήρης ἐστὶν ὁ κατὰ τὴν κόρην τόπος).

Similarly, when discussing eye afflictions in *On Affected Parts*, Galen insists that the doctor should only make rational diagnoses (λογικὰς διαγνώσεις),<sup>55</sup> i.e. not relying on sense alone, but on reason. Indeed, sight disorders are deep afflictions, the origins of which cannot be precisely pinpointed by observation and the causes of which must be identified by reason. Apart from various traumas and readily identifiable cases of paralysis due to motor nerve failure, which can also affect the movement of the eye and eyelids, leading to severe squints, the loss of visual sensitivity can be explained, in all other cases, by the lesion of the optic nerve: 'When vision is lost without any apparent damage to the eye, it is due to the nerve that goes from the brain to the eye, either because it is inflamed or afflicted by a scirrhus, or is damaged in some other way, either by the flow of the humours, or by the obstruction of the passage that exists at its centre'.<sup>56</sup> In both these types of lesions, whether of organic or humoral origin, the *pneuma* can no longer flow and pass through. A third case corresponds to its simple drying up, when 'the light *pneuma* no longer arrives or arrives in a very small amount from its origin in the brain'.<sup>57</sup>

Apart from these cases where the *pneuma* fails, other afflictions that occur in the absence of a visible eye lesion can be explained by sympathy, that is, through other afflictions and their effects on the eye.<sup>58</sup> Thus, certain sight distortions (φαντάσματα), similar to those caused by cataracts, are really produced by sympathy with an illness of the stomach opening, not by an actual eye affliction. Indeed, poorly cooked food leads to harmful humours which somehow reach into the brain. The accumulation of bilious humour in the brain causes it to suffer something resembling 'what objects roasted on a fire experience' (παραπλήσιόν τι πάσχει τοῖς ὑπὸ πυρὸς ὀπτωμένοις), and the kind of smoke produced, seeping into the passages leading to the eye, obscures sight and sometimes even produces visions.<sup>59</sup>

<sup>55</sup> Galenus, *De locis affectis* 4.1 (8.217, 1–2 K.).

<sup>56</sup> Galen, *De loc. aff.* 4.1 (8.218.3–8 K.).

<sup>57</sup> Galen, *De loc. aff.* 4.1 (8.218.10–12 K.).

<sup>58</sup> Galen, *De loc. aff.* 4.1 (8.221.15–18 K.).

<sup>59</sup> Galen, *De loc. aff.* 4.1 (8.218.10–12 K.). Galen indifferently calls these visions by two nouns: φαντασῖαι and φαντάσματα.



Only an appropriate diet, in particular the taking of a bitter, aloë-based, medication called *picra* (πικράν), can overcome such afflictions, rather than an ophthalmic treatment, which in this instance plays no role.

Finally, other visions originate directly in the brain following its affection by certain forms of phrenitis, a type of mental illness that affects intellectual judgement or the senses, or both. In the *On Affected Parts*, Galen gives a famous example of this affliction, mentioning the case of a Roman suffering from phrenitis who, from his home, as he could see passers-by and be seen by them (οἷόν τ' ἦν ὁρᾶσθαι τε αὐτὸν καὶ ὄραν τοὺς παριόντας), threw his glass vases out of the window one after the other until, spurred on by the crowd, he also threw out his slave.<sup>60</sup> Galen himself, afflicted with a burning fever in his youth, remembers thinking he saw 'dark twigs flutter about his bed', which he unsuccessfully tried to grab. However, although he was suffering from these kinds of visions, his sense of judgment and intellectual abilities remained intact, since he understood simply by listening to his friends' comments that he was afflicted by crocidismus and carphology (κροκυδίζει τε καὶ καρφολογεῖ), a terminology that is still in use amongst modern doctors.<sup>61</sup>

Thus, the analysis of these two final cases confirms, were it still necessary, that, other than vision disorders caused by sympathy and diseases directly affecting the brain, all other defects of vision are directly attributable to *pneuma*.

Following this analysis, and despite Galen's efforts to collect together the sum of ancient knowledge, it should be pointed out that the Galenic physiology of sight rests on two major errors: the crystalline lens is not, as Galen thought, the place where visual images are formed and, even more importantly, the circulation of an optical *pneuma* (πνεῦμα ὀπτικόν) is not the cause of vision. There is another major difficulty: Galen does not tell his reader how to reconcile a geometrical theory of vision that involves straight lines (γραμμᾶς) and not rays (a term whose use, we have seen, he rejects),<sup>62</sup> with an almost omnipresent *pneumatic* theory.<sup>63</sup> Nevertheless, this theory would be accepted in this form by most doctors who lived

<sup>60</sup> Galen, *De loc. aff.* 4.1 (8.226.2–11 K.).

<sup>61</sup> Galen, *De loc. aff.* 4.1 (8.227.3 K.). The verb κροκυδίζει means literally 'to tear off strands or flakes of wool from a fabric' and καρφολογεῖ 'to collect strands of straw', two gestures which can be observed in patients in a terminal phase.

<sup>62</sup> See *supra* n. 28.

<sup>63</sup> A possible solution would presume that these straight lines follow the path traced by the *pneuma* emitted by the eye towards the perceived object. However, there is nothing in Galen's text that explicitly suggests this interpretation.

after Galen, whether Greek, Latin or Arabic, until the end of the sixteenth century.<sup>64</sup> As Vanagt has shown in her contribution to the present volume, the Galenic theory of vision would serve in the Renaissance as a basis for the important debate on the *modus visionis*, either because his defenders ingeniously competed to reconcile Galen's propositions with their own observations, or because the Galenic theory of pneumatic emission was gradually undermined by the discoveries of Plempius, Della Porta and, finally, Kepler. However, the exceptional longevity of Galen's theory of vision cannot be explained only by the scientific authority which the author enjoyed for so long. In a more subtle way, it is probably also due to the mystery of the physiological process of vision, to the indisputable complexity of the organ being studied, but also to the particular status of the eye, which Georges Rodenbach called the window of the soul, an expression to which Aristotle would have subscribed.<sup>65</sup> By asserting the retina to be part of the brain and defining the eye as the most divine organ (τὸ θειότατον ὄργανον),<sup>66</sup> Galen could not hope to solve the mystery of vision, which he himself declared as being similar to that of the soul. Thus, when in his *On the Doctrines of Hippocrates and Plato* Galen prefers to withhold his judgement on the nature of the mysterious *pneuma*, which is at the heart of his theory of vision, he displays a certain caution similar to that observed in *On my own Opinions* concerning the nature of the soul, knowledge of which he admits to possessing: not a certain knowledge (βεβαίαν γνῶσιν), but only a probable one (ἄχρι τοῦ πιθανοῦ).<sup>67</sup> And Aristotle's phrase, which appears in this paper, leaves no doubt that, just as for Galen in the *On the Best Method of Teaching*,<sup>68</sup> vision is to the eye what intelligence is to the soul; the mystery of sight, like that of the soul, with which it shares an immense and elusive fascination, constitutes one of the biggest puzzles confronting human understanding.

<sup>64</sup> See Siegel, *Galen on Sense Perception* 124–126.

<sup>65</sup> Rodenbach G., *Bruges-la-morte* (Paris: 1892).

<sup>66</sup> Galen, *De usu part.* 10.12 (3.812.15 K.).

<sup>67</sup> Galen, *De propr. plac.* 14 (114,12 Nutton = Boudon-Millot, V. – Pietrobelli A., "Galen ressuscité: Édition princeps du texte grec du *On my own opinions*", *Revue des Études grecques* 118 (2005) 188 for the Greek text and 210 for the French translation).

<sup>68</sup> Compare Arist. *Top.* 108a11 ('ὡς ὁψις ἐν ὀφθαλμῷ, νοῦς ἐν ψυχῇ'), "as sight is in the eye, so mind is in the soul" and EN 1096b29 ('ὡς γὰρ ἐν σώματι ὁψις, ἐν ψυχῇ νοῦς') with Galen, *De optima doctrina* 5 (106,12 Barigazzi; 1.52.1–9 K.): 'εἰ δ' ἐστὶ μὲν οἶδος περ ὀφθαλμοῦ ἐν σώματι, τοιοῦτος ἐν ψυχῇ νοῦς', 'If the eye is in the body, so the mind is in the soul'.

*Selective bibliography*

- BOUDON-MILLOT V., "Illustrer les médecins grecs à la Renaissance: Les schémas d'optique galénique", in Boudon-Millot V. – Cobolet G. (eds.), *Lire les médecins grecs à la Renaissance. Aux origines de l'édition médicale* (Paris: 2004) 209–232.
- , "La théorie galénique de la vision: couleurs du corps et couleurs des humeurs", in Villard L. (ed.), *Couleurs et vision dans l'Antiquité classique* (Rouen: 2002) 65–75 [Serbian translation under the title "Galenska teorija o vidu: boje tela i boje tecnosti", *Lucida intervalla* 28, 2 (2003) 32–43].
- CRAIK E. (ed.), *Two Hippocratic Treatises on Sight and on Anatomy* (Leiden: 2006).
- FRONIMOPOULOS J. – LASCARATOS J., "The terms *glaucoma* and *cataract* in the ancient Greek and Byzantine writers", *Documenta Ophthalmologica* 77 (1991) 369–375.
- GRMEK M., "Albule oculorum: cataracte ou taies de la cornée?", in Deroux C. (ed.), *Maladie et maladies dans les textes latins antiques et médiévaux* (Brussels: 1998) 422–433.
- HIRSCHBERG J., "Geschichte der Augenheilkunde", in Gräfe A. – Sämisch Th. (eds.), *Handbuch der gesamten Augenheilkunde* 12 (Leipzig: 1899).
- JOUANNA J., "Soleil, toi qui vois tout: Variations tragiques d'une formule homérique et nouvelle étymologie de ἀκτίς", in Villard L. (ed.), *Études sur la vision dans l'Antiquité classique* (Rouen: 2005) 39–56 (= Chronique d'étymologie grecque 11, *Revue de Philologie* 80 (2006) 343 s. v. ἀκτίς).
- MAGNUS H., *Die Augenheilkunde der Alten* (Breslau: 1901).
- MARGANNE M.-H., "Glaucome ou cataracte? Sur l'emploi des dérivés de γλαυκός en ophtalmologie antique", *History and Philosophy of the Life Sciences* I, 2 (1979) 199–214.
- , *L'Ophtalmologie dans l'Égypte gréco-romaine d'après les papyrus littéraires grecs* (Leiden: 1994).
- MUGLER Ch., *Dictionnaire historique de la terminologie optique des Grecs* (Paris: 1964).
- SAVAGE-SMITH E., "Galen's Lost Ophthalmology", in Nutton V. (ed.), *The unknown Galen* (London: 2002) 121–138.
- SIEGEL R.E., *Galen on Sense Perception* (Basel-New York: 1970).



EARLY MODERN MEDICAL THINKING ON VISION AND  
THE CAMERA OBSCURA.  
V.F. PLEMPIUS'S *OPHTHALMOGRAPHIA*

Katrien Vanagt

*Summary\**

The 'modus visionis' was one of the most fascinating and fashionable topics in early modern thought. It is well-known that early modern philosophers, mathematicians, artists, magicians and astronomers took a particular interest in vision and discussed it extensively. Less well-known is that medical doctors too, debated how vision occurred, trying to find a way out of the impasse created by the contradictions between Aristotle and Galen. Although many of them explicitly claimed to be following in the footsteps of Galen, their actual theories were often quite different from his, being closer to Aristotle than is usually acknowledged.

I will argue that, by introducing the camera obscura as an explanatory model for the functioning of the eye, V.F. Plempius's aim was to resolve an ongoing debate, in a spectacular and original way. He borrowed the innovations and experiments of other fields of knowledge, but looked at them as a medical doctor: by analysing the relevance of the camera for medical thinking he was able to give such innovations a new meaning.

*Introduction*

In his famous *Magia naturalis* of 1589, Giambattista della Porta (ca. 1535–1615), Italy's foremost magus and wonder-worker, writes that

... nothing can be more pleasant for great men, and scholars, and ingenious persons to behold. That in a dark chamber by white sheets objected, one may see as clearly and perspicuously, as if they were before his eyes, huntings, banquets, armies of enemies, plays, and all things else that one desires. Let there be over against that chamber, where you desire to represent things, some spacious plain, where the sun can freely shine [...]. you must counterfeit Stags, Boar, Rhinocerets, Elephants, Lions, and what other creatures you please. Then by degrees they must appear, as coming out of their dens, upon

---

\* I would like to thank Fokko Jan Dijksterhuis, Helen King and the anonymous reviewer for their helpful comments on earlier versions of this paper.

the plain. The hunter must come with his hunting pole, nets, arrows, and other necessities, that may represent hunting [...]. Those that are in the chamber shall see trees, animals, hunters faces, and all the rest so plainly, that they cannot tell whether they be true or delusions.<sup>1</sup>

The camera obscura, as Della Porta showed, could be used as entertainment; it was one of the many objects of *wonder* that amused early modern European society.<sup>2</sup> Large models were built for this and other purposes at several courts in Europe, including the court in Dresden.<sup>3</sup> Creating illusions and wonder was indeed one of the characteristic features of court culture, with its eagerness for spectacle and the display of knowledge, and as such it forms part of the so-called tradition of 'natural magic'.<sup>4</sup>

But the camera obscura had other functions too. Different kinds of people, with different backgrounds, aims and agendas were involved in experiments with the camera obscura. Artists were fascinated by the possibilities of using the camera as a drawing aid for reproducing an exact copy of the world outside. Astronomers used it to observe solar eclipses in order to protect their eyes against direct sunlight. Mathematicians and philosophers relied on experiments with the camera to learn something about the behaviour of light.<sup>5</sup>

Indeed, the camera was more than just an instrument for spectacular entertainment. Entertainment went hand in hand with learning, as playing with the camera was a way of generating knowledge.<sup>6</sup> To wonder about the object of wonder, to wonder about its working and causes, was a way of investigating nature. One of the prerogatives of natural magic –

---

<sup>1</sup> Porta Giambattista della, *Natural Magick* (London, Thomas Young and Samuel Speed: 1658) 336.

<sup>2</sup> On wonder and 'praeternatural' history, see Daston L. – Park K., *Wonders and the Order of Nature, 1150–1750* (New York: 1998).

<sup>3</sup> The darkened room formed part of the Dresden Kunstkammer, see Dupré S., "Playing with Images in a Dark Room: Kepler's *Ludi* inside the Camera Obscura", in Lefèvre W. (ed.), *Inside the Camera Obscura. Optics and Art under the Spell of the Projected Image* (Berlin: 2007) 59–74.

<sup>4</sup> On Della Porta and natural magic, see Eamon W., *Science and the Secrets of Nature, Books of Secrets in Medieval and Early Modern Culture* (Princeton-New Jersey: 1999) 194–233.

<sup>5</sup> For a concise historical sketch of the camera obscura, see Hammond J.H., *The Camera Obscura. A Chronicle* (Bristol: 1981); for a deeper analysis of the optics involved in the camera, see the contributions in Lefèvre, *Inside the Camera* part 2.

<sup>6</sup> On the importance of play in Kepler's experiments with the camera, see Dupré, "Playing with Images"; on the status of play in early modern culture, see Findlen P., "Jokes of Nature and Jokes of Knowledge: The Playfulness of Scientific Discourse in Early Modern Europe", *Renaissance Quarterly* 43 (1990) 292–331.

compared to other types of magic – was precisely that the tricks and illusions could be explained by natural principles. If this was so, it was in great part thanks to the efforts of Della Porta, who, according to William Eamon, ‘from his first juvenile effort to his last unpublished work, [...] dedicated his life to establishing natural magic as a legitimate empirical science’.<sup>7</sup>

It is thus not surprising that Della Porta himself recognised the philosophical significance of his camera in claiming that it teaches not only something about light – a claim already made previously by mathematicians – but also something about the way we see and the working of the eye.<sup>8</sup> This idea was taken up in 1583 by Felix Platter (1536–1614), a well-known physician from Basel, who explicitly refers to the eye as a *camera obscura* in his anatomical work *De corporis humani structura et usu*.<sup>9</sup> But this was no more than a brief statement, without any emphasis or direct explanation, and presented in the form of schematic tables. In 1604, the analogy between the working of the camera and the eye was fully developed, not in a medical work, but in the astronomical treatise *Ad Vitellionem paralipomena* by Johannes Kepler (1571–1630), at that time mathematician and astronomer at the court of Rudolf II in Prague. He explored the camera thoroughly, provided a detailed mathematical explanation of its effect on the behaviour of light, and used those findings to elaborate a new theory of vision.<sup>10</sup> The Jesuit mathematician Christoph Scheiner (1573–1650), in turn, took over Kepler’s principal innovation of the retinal image, but adopted a more empirical and experimental approach to the problem in his *Oculus, hoc est fundamentum opticum* of 1619.<sup>11</sup> As the title of his work suggests, he focused directly on the eye.

<sup>7</sup> Eamon, *Secrets* 196.

<sup>8</sup> Lindberg D.C., *Theories of Vision from al-Kindi to Kepler* (Chicago-London: 1976) 184–185.

<sup>9</sup> The function of the *uvea* is ‘ut *obscuram* sic faceret *oculi cameram*’, (my italics). Platter Felix, *De corporis humani structura et usu libri III* (Basel, Ambrosius Frob.: 1583) 186.

<sup>10</sup> Kepler Johannes, *Ad Vitellionem paralipomena quibus astronomiae pars opticae traditur* (Frankfurt, Claudius Marnius and Haeredes Ioannis Aubrius: 1604). For an analysis of Kepler’s theory of vision, see Lindberg, *Theories of Vision* 178–208. On the epistemological meaning of Kepler’s new optical theory, see Simon G., *Sciences et Savoirs aux XVI<sup>e</sup> et XVII<sup>e</sup> siècles*, Histoire des sciences (Lille: 1996) 77–101.

<sup>11</sup> Scheiner Christoph, *Oculus, hoc est. Fundamentum opticum* (Innsbruck, Daniele Agricola: 1619). On Scheiner’s use of ‘experiments’ and ‘experiences’, the distinction between them, and the historical significance of this, see Dear P., *Discipline and Experience* (Chicago-London: 1995).



In the medical world, however, Platter's suggestion of the eye as a dark room was slow to find support. Medical doctors continued to discuss what they called the 'modus visionis' without reference to the camera. It was fifty years before the camera obscura appeared again in a medical work as a means of explaining the physiology of sight. With the first edition of Vopiscus Fortunatus Plempius' (1601–1671) treatise on the eye in 1632, the *Ophthalmographia*, the idea is developed in all its beauty and constitutes the key to what Plempius proudly calls the new and true 'modus visionis'.<sup>12</sup>

This is not to say that physicians had no interest in the way vision takes place. On the contrary, the so-called 'modus visionis' constituted one of the central topics of debate among late sixteenth and early seventeenth-century physicians, as I will briefly argue in the first part of this chapter. Unlike David Lindberg, who argues that early modern medical theories of vision were predominantly Galenic (with only a few exceptions), I believe that the picture was far less homogeneous and that physicians were less uniform in their beliefs than his account might suggest.<sup>13</sup> Physicians were aware of alternative responses to vision, and clearly often struggled in an attempt to integrate them into their own physiological account of sight. I will not be concerned here with the ancient theories of vision themselves – I am glad to refer to the contribution of Véronique Boudon-Millot elsewhere in this volume, who gives a brief account of the different theories of vision in Antiquity and a detailed analysis of Galen's ideas on vision that constitute the basis of all early modern medical thinking of vision – but with the reception of those theories within early modern medical thinking.<sup>14</sup> What I want to show is that, by introducing the camera as an explanatory model for the functioning of the eye, Plempius' aim was to resolve an ongoing debate, in a spectacular and original way.

In the second part, then, I will discuss the introduction of the camera obscura into *medical discourse*, analysing how Plempius presents the camera and what he – as a medical doctor – finds important about it. I will argue that Plempius, by staging the wondrous camera obscura as a

---

<sup>12</sup> The full title of the first edition reveals Plempius' ambitious project: *Ophthalmographia, sive tractatio De oculi fabrica, actione et usu praeter vulgatas hactenas, philosophorum ac medicorum opiniones*. Note that my references will be to the second edition, published in Louvain in 1648, which was almost unchanged with respect to the first, apart from the book on therapy.

<sup>13</sup> Lindberg, *Theories of Vision* 175.

<sup>14</sup> See the contribution of V. Boudon-Millot in this volume, 551–567.

real *deus ex machina*, and explaining the natural causes responsible for its working, tried to resolve contemporary questions on the 'modus visionis'. In order to do so, Plempius borrowed the innovations and experiments of Kepler and Scheiner, but looked at them as a medical doctor. By explicitly pointing at the relevance of the camera for medical thinking, he was able to give these a new meaning.

### 1. *The medical debate on the 'modus visionis'*

#### *Intromission-extramission*

At the heart of the medical discussion on the 'modus visionis' lay the famous question about the direction of rays in vision, the so-called intromission-extramission question: do we see by receiving something into the eye or do we see by sending something forth? The discussion can be traced directly back to Antiquity, where – stated very simply – Aristotle stood for intromission, Plato for emission and Galen for a different version of emission.<sup>15</sup> Far from being resolved, the question remained very much alive in early modern thinking.

At first sight, Lindberg seems right in stating that early modern medical theories of vision were Galenic, since many physicians explicitly advocated Galen's extramission theory. However, a close look at the texts themselves reveals that the choice of Galen was less evident than we might have thought. They clearly disliked the idea of opposing Aristotle's view on vision. This rather unusual intrusion of Aristotle as an authority within medical discourse has much to do with the nature of the question. It was perceived to be essentially a philosophical issue, closely linked to questions on the soul and heavily debated in commentaries on Aristotle's *De anima*.<sup>16</sup> The main problem for physicians in the context of the 'modus visionis' was indeed the relation between medicine and natural philosophy, each falling back on two different authorities.<sup>17</sup> If 'Aristotelian

<sup>15</sup> Details about the different theories can be found in Boudon-Millot, this volume.

<sup>16</sup> On the importance of Aristotle in Renaissance university learning, see Schmitt C.B., *Aristotle and the Renaissance* (Cambridge, Mass.: 1983).

<sup>17</sup> On the relationship between medicine and natural philosophy, see French R., *Medicine before Science. The Rational and Learned Doctor from the Middle Ages to the Enlightenment* (Cambridge: 2003).

natural philosophy was known to and used extensively by Galen',<sup>18</sup> their views on the 'modus visionis' were radically different. Galen had to be reconciled with Aristotelian intromission. Physicians tried therefore, by a variety of means, to enlist Aristotle into their own camp. Some, as I will show, found a solution by ascribing emission to Aristotle. Others, in order to remain closer to Aristotle's opinion, stressed the intromissionist component of Galen's theory.

Take, for example, Girolamo Capivaccio (1523–1589), a prominent Italian physician. He refers to the question in the physiological part of his *Opera omnia*, and explicitly chooses the Galenic extramission theory. However, if we examine his argument in more detail, we will note that his choice of Galen was less evident, and his actual theory less Galenic, than his faithful reverence to Galen seemed to imply. Clearly concerned that he was opposing Aristotle's intromissionist theory, Capivaccio tries to ascribe some extramission to Aristotle by relying on his *Problemata* (today regarded as pseudonymous). If Aristotle seems to deny extramission, he says, it should be understood as an extramission of the faculty. However, he continues, Aristotle *does* agree with some extramission of rays when he writes that the pupil is sparking off light just as a candle does.<sup>19</sup>

Capivaccio then claimed Galen's theory to be the perfect compromise between Aristotle and Plato, given that it incorporates both options: 'it is clear that vision is made both by intromission, and by extramission', he states.<sup>20</sup> However, the way in which he introduces his final argument on the question suggests that things may not be as clear as he has claimed. He adds that we should know that vision must be considered in two senses, 'in order to take away all ambiguity'.<sup>21</sup> What he means by this is that we should distinguish between simply 'seeing', on the one hand, and 'looking at', on the other.<sup>22</sup> And for seeing alone, 'it is not necessary that something is emitted', he claims, thus explicitly contradicting the Galenic theory. Instead of clearing up the argument, he thus seems to make it only

<sup>18</sup> French, *Medicine before Science* 3.

<sup>19</sup> Capivaccio Girolamo, *Opera omnia*, ed. Hartmannus J. (Frankfurt, E. Paltheniana-Iona Rodius: 1603) 141 'Extramissionem videtur negare Aristoteles [...]: quod intelligendum de extramissione facultatis, quae concedi non potest. Radiorum enim extramissionem etiam Aristoteles statuit [...] ubi ait pupillam, id est spiritum animale in pupilla contentum, ad similitudinem candelae accensae in lucerna, lumen spargere, seu radios extramittere'.

<sup>20</sup> Capivaccio, *Opera omnia* 141 'patet visionem fieri et intromissione, et extramissione'.

<sup>21</sup> Capivaccio 141 'ut omnis tollatur ambiguitas'.

<sup>22</sup> Capivaccio is opposing *visio* 'simpliciter' to *visio* 'respective', 141.

more confused, and even more remote from the original Galenic theory he had so emphatically claimed to be adopting.

Julius Casserius (1561–1616), professor of anatomy at the University of Padua, approaches the problem in similar terms and calls the ‘visionis contemplatio’ very ‘difficult’, both because of the intrinsic difficulties of the question and because of the contradicting opinions between different philosophers.<sup>23</sup> What makes the question so difficult is that there is no consensus between them.<sup>24</sup> Again, the only way out, according to Casserius, is to follow in the footsteps of Galen. Yet, despite his faithfulness to Galenic teaching, he does not follow him slavishly. On the contrary, he comes up with new arguments in favour of extramission and, even more importantly, offers a very original interpretation of extramission that bears little trace of the original Galenic view: extramission for him no longer signifies an emission out of the eye, but rather an emission of spirits *within* the eye from the crystalline humour to the pupil, where, according to Casserius, the image of the outside world is formed. It is thus extramission only in so far as spirits leave the crystalline humour. It is also interesting that, as a medical doctor, he finds he is in the best position to solve the philosophical problems: knowledge of the pathology of the eye gave physicians, in their own view, a certain superiority over philosophers in teaching them new and valuable elements relevant to the process of seeing.

Not all physicians were professing Galen – at least formally – as the prime Authority, however. Probably the best known example of a medical approach to the ‘modus visionis’ can be found in the anatomical treatise *De visione* of Hieronymus Fabricius ab Aquapendente (1537–1619), famous for his role in the development of anatomical teaching at the University of Padua.<sup>25</sup> Fabricius too is troubled by the disagreement between the classical authorities. Yet, in his attempt to reconcile them, he considers not Galen’s theory, but that of Aristotle, as the best compromise, and thus openly chooses intromission as the only valuable option.<sup>26</sup>

<sup>23</sup> Casserius Julius, *Pentaestheseion* (Venice, Nicolaus Misserinus: 1609) 296 ‘Visionis contemplatio quam sit ardua, quam variis difficultatum involucris implicata, nemo est, qui ambigit, modo dissentientes et varias variorum philosophorum sententias’.

<sup>24</sup> Casserius 296 ‘inter se philosophi digladiantur’.

<sup>25</sup> Fabricius ab Aquapendente Hieronymus, *De visione, voce, auditu* (Venice, Franciscus Bolzetta: 1600).

<sup>26</sup> Fabricius, *De visione* 39–42.

*Medical thinking on vision*

Physicians introduced their own particular set of problems and questions within the discussion on the 'modus visionis'. Apart from the question of the direction of radiation, other favourite points of discussion include the presence of internal light within the eye. Many physicians believed that the eye itself possessed some kind of light that was necessary in order to see well.<sup>27</sup> The seat of vision, too, was the subject of much controversy. Early modern physicians are not so much interested in what happens outside the eye, as in what happens *within* the eye: what is the nature of the eye (passive-active), the seat of vision, the role of the internal light and of the visual spirits, how images are assimilated by the eye in order to produce vision and, last but not least, how we can explain defective vision. This final point is important, and probably the most distinctive feature of the medical theories of vision. Physicians had to fit their thoughts or theories within the medical – and thus therapeutic – discourse. They needed to formulate a theory of vision that would not contradict the current (i.e. traditional) ideas on the causes of disease and therapy.

That physicians' ideas about the 'modus visionis' were closely linked to their insights into ocular diseases – through the intermediary of *pneuma* or visual spirits – is a direct heritage from Galen. As we can see in Boudon-Millot's paper, in Galen's system *pneuma* constituted the basis of his entire visual theory.<sup>28</sup> Following in the steps of Galen, for most of the early modern doctors, the key to good sight lay in the *spiritus visivus*, because they possessed the visual power and were supposed to carry the forms or *species* from the world outside into the eye to produce vision. The state of these spirits was therefore critically important for good sight, and, in case of problems with sight, they would be the first ones to be blamed. As spirits were thought to be generated by a whole series of bodily processes out of the blood and the air, they formed the direct link between the eyes and the body. Thanks to them, the condition of the eyes was made directly dependant on the well-being of the entire body, as was necessary within the holistic approach that had characterised medical discourse since Antiquity.

---

<sup>27</sup> See Vanagt K., "Suspicious Spectacles: Medical Perspectives on Eyeglasses, the Case of Hieronymus Mercurialis", in Helden A. van – Dupré S. – Gent R. van – Zuidervaart H. (eds.), *The Origins of the Telescope, History of Science and Scholarship in the Netherlands* 12 (Amsterdam: 2010) 115–129.

<sup>28</sup> Boudon-Millot, "Vision and Vision Disorders", 556–559.

Since new ideas always had to match the medical framework with its spirits and visual power, it was more difficult for physicians to come up with new insights into ocular physiology. Paradoxically, as the example of Casserius shows, some early modern physicians appeared to view the medical framework not as an obstacle, but as an opportunity to enrich the question with additional information, and, in doing so, to resolve the impasse. They adduced their knowledge of ocular diseases, as a supplementary but strongly weighted argument in their (new) ideas on the 'modus visionis', and thus turned what we would suppose to be their disadvantage into their advantage.

### *Continuity and change*

New elements made their entrance into medical thinking on vision: anatomical observations were responsible for discovering new structures in the eye and the brain, and optical thinking challenged the functions of its parts by introducing new concepts into the theory of vision, such as refraction.<sup>29</sup> Yet the authorities from Antiquity remained inescapable and still constituted the major reference point. It is striking that the physicians' reverence for the authors themselves was greater than that for their actual theories. They were not so much concerned about the original context and meaning of the ancient texts and ideas on vision. More important was that such texts could be interpreted in a way that fitted their personal insights, updated with new elements. In fact, almost every respected physician came up with new ideas, and thus with his own version of 'Galenism', whether or not this was enriched with elements from other fields of knowledge.

Sometimes the reference to Galen and his 'extramission' theory appeared to be no more than an empty *façade*. It can thus be very misleading to judge theories on the basis of certain names or concepts, as the concepts may have changed meaning. To say that, generally speaking, early modern vision was Galenic is thus to miss an essential part of the argument. As we have seen, in some more extreme cases Galenic extramission could almost come to mean its opposite: namely, intromission.

---

<sup>29</sup> On the assimilation of optical concepts into anatomical discourse, see Vanagt K., "Hoe men zich voor brillen behoeden kan' of de moeizame verspreiding van optische kennis in vroegmoderne medische kringen", *Gewina* 29 (2006) 26–40.

Instead, what was truly Galenic was the general medical framework, with its reliance on spirits.

In short, early modern medical writings on vision testify that there was a kind of an impasse between medical and philosophical reasoning, and their authors tried hard to find a solution. This situation gave way to several more or less visible – and at times highly original – cracks in the traditional ‘modus visionis’, other than its essence: the intricate relation between eyes and body through the intermediary of the spirits or, to put it in another way, the dependence on the body by means of the spirits.

## 2. *Plempius and the camera obscura*

### *Plempius' life*

In modern literature, Vopiscus Fortunatus Plempius is mainly known for his participation in some of the famous scientific polemics of his time, such as the introduction of Cartesianism in academic teaching and the circulation of the blood. First known as a detractor of William Harvey (1578–1657), Plempius would soon turn into one of his most fervent and early supporters; this famous ‘conversion’ story is often repeated by historians.<sup>30</sup> As for Cartesianism, Plempius made a similar shift. While he first openly advocated Cartesianism, after an investigation by the University of Louvain concluded by prohibiting Cartesian teaching, he moved to the opposite camp and banned Cartesianism from university teaching with the same vehemence as he had deployed in the discussion on the circulation of the blood.<sup>31</sup> These and other polemics all date from the latter period of his life, when he was a respected professor at the University of Louvain. The *Ophthalmographia*, in which Plempius exposes his ideas on vision, however, was conceived and constructed just before the start of his academic career in Louvain. In order to grasp more fully the spirit in

<sup>30</sup> On his role in the polemic on the circulation of the blood, see Greene M., “The Heart and Blood: Harvey, Descartes and Plemp”, in Voss S. (ed.), *Essays on the Philosophy and Science of René Descartes* (Oxford: 1993) 324–336; French R., *William Harvey's Natural Philosophy* (Cambridge: 1994), ch. 8.

<sup>31</sup> On Plempius' relation to Descartes and Cartesianism, see Monchamp G., *Histoire du Cartésianisme en Belgique, Mémoires couronnés et autres mémoires* 39 (Brussels: 1886); Lindeboom G.A., *Descartes and Medicine, Nieuwe Nederlandse bijdragen tot de geschiedenis der geneeskunde* 1 (Amsterdam: 1979).



which the *Ophthalmographia* was written, it is thus important to give a brief sketch of those earlier years.

Plempius, born in Amsterdam in 1601 into a Catholic family, began his education in the Southern Netherlands. Sent to a college in Ghent, he then followed the Arts course at the Catholic University of Louvain. It is worth mentioning that among his teachers there was the prominent philosopher and mathematician Libert Froidmont (1587–1653), whose teachings on optics profoundly marked Plempius and laid the basis for his ideas on vision, as he himself acknowledges in his *Ophthalmographia*.<sup>32</sup> For his medical studies, however, Plempius returned to the North and enrolled at the recently-founded University of Leiden, known for its rich botanical garden and fine anatomical teaching. Some years later, attracted by the fame of the anatomist Adriaan van den Spiegel (1578–1625), Plempius embarked on a study trip to Padua and Bologna, where he finally obtained his doctorate in medicine. In 1623, he was back in Amsterdam to start a medical practice and was soon counted among the foremost physicians of the city. He would stay there for ten years, until he was appointed professor of medicine at the University of Louvain. This marks the beginning of an intensive academic career that would last until his death in 1671.<sup>33</sup>

I will focus here on the work of the younger Plempius, when he was in his twenties, as a young intellectual and practising physician in Amsterdam. It is in those early years that he was developing – and, as I will show, literally *constructing* – his ideas on the physiology of sight, as published in his *Ophthalmographia*. His social situation was quite different at that time to that of his later career. Although he was probably aspiring to a university position, he was still free of institutional boundaries.<sup>34</sup> In Amsterdam, Plempius was in close contact with some of the leading figures of the cultural and scientific elite. Consider, for example, his connections with Nicolaes Tulp (1593–1674), one of the ‘regenten’ of the city, influential physician and praelector of anatomy, immortalised in Rembrandt’s well-known *Anatomy Lesson*; his relation to Jacobus Golius (1596–1667), professor of Arabic and mathematics at Leiden University known for his

<sup>32</sup> See Plempius’ letter to the reader in the first edition of the *Ophthalmographia*.

<sup>33</sup> On Plempius’ life, see Tricot J.P., “Vopiscus Fortunatus Plempius”, *Vesalius* 6 (2000) 11–19; Lindeboom G.A., *Dutch Medical Biography. A Biographical Dictionary of Dutch Physicians and Surgeons 1475–1975* (Amsterdam: 1984) 1544–1546.

<sup>34</sup> As to his academic ambitions, the first edition of the *Ophthalmographia* was dedicated to the professors of medicine at the University of Leiden. The repeated references to Froidmont may point in a similar direction.

immense collection of old manuscripts, with whom Plempius took lessons in Arabic; and his close friendship with René Descartes (1596–1650). Through his friendship with Descartes, Plempius was indirectly linked to the circle of French philosophers such as Isaac Beeckman (1588–1637), Nicolas-Claude Fabri de Peiresc (1580–1637), Marin Mersenne (1588–1648) and Pierre Gassendi (1592–1655). It is probably no coincidence that they all placed a high value on sensory experiments, and that they were all equally fascinated by vision. We know for instance that Peiresc's active interest in understanding and exploring the 'modus visionis' was stimulated by his reading of Plempius's *Ophthalmographia*.<sup>35</sup> It is also important to stress that Plempius was actively engaged in anatomy, not only through public demonstrations and publications on the subject, but also through his tireless dissection of bodies or bodily parts at home.<sup>36</sup>

The religious and political environment too was quite different in Amsterdam than in his later years in Louvain. The protestant Dutch Republic was then in its so-called Golden Age, and this prosperous environment certainly influenced his 'thoughts' and 'practices'. In fact, it is very likely that the Dutch climate nurtured Plempius' interest in natural history and empiricism, and his familiarity with the wondrous effects of optical devices. Although in Amsterdam there was no court culture, there were plenty of wealthy merchants, pharmacists and physicians who – much like courtiers – participated in the contemporary interest in collecting and creating natural wonders.<sup>37</sup> Many of them had their own natural historical collections, often impressive and well-known in other countries, attracting visitors from all over Europe.<sup>38</sup> Such collections often

<sup>35</sup> On the connections between those French philosophers, see Cook H.J., "The New Philosophy in the Low Countries", in Porter R.-Mikulás (eds.), *The Scientific Revolution in National Context* (Cambridge: 1992) 128–129. On their common interest in vision, see Armogathe J.-R., "The Rainbow: A Privileged Epistemological Model", in Gaukroger S. – Schuster J. – Sutton J. (eds.), *Descartes' Natural Philosophy* (London-New York: 2002) 249–257. On Plempius' influence on Peiresc, see Bloch O.R., *La philosophie de Gassendi. Nominalisme, matérialisme et métaphysique*, *Archives Internationales d'Histoire des Idées* 38 (The Hague: 1971) 6.

<sup>36</sup> Plempius Vopiscus Fortunatus, *Verhandelinge der spieren* (Amsterdam, Jacob Aerts.: 1630); Cabrolus Bartholomaeus, *Ontleeding des menschelycken lichaems*, tr. Plempius V.F. (Amsterdam, Hendrick Laurensz.: 1633).

<sup>37</sup> Harold Cook has recently highlighted the relationship between the Dutch mercantile state and the development of medicine, and gives an excellent contextualised account of medicine in the Dutch Republic, Cook H.J., *Matters of Exchange. Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven-London: 2008).

<sup>38</sup> On medical collections in Holland at the turn of the seventeenth century, see Swan C., "Making Sense of Medical Collections in Early Modern Holland: The Uses of Wonder",

included optical devices. The impressive ‘Cunstcamer’ of Christiaen Porret (1554–1627), for instance, a French-born pharmacist in Leiden, included optical devices, as can be deduced from the auction catalogue of his collection that was printed in 1628, one year after his death.<sup>39</sup> Of Constantijn Huygens (1596–1687), we know that he possessed a camera obscura.<sup>40</sup> We should also bear in mind the high value that was placed on anatomical dissection in the Republic: efforts by the curators of Leiden University to attract the foremost anatomists; the construction of a proper anatomy theatre; the popularity of the public dissections in Amsterdam; the popularity and number of newly-published anatomical works.<sup>41</sup>

### *The Camera Obscura in the Ophthalmographia*

The *Ophthalmographia* of 1632 consists of five books. It is in Book Two, on the function (*actio*) of the entire organ, that Plempius explains his ‘modus visionis’. Plempius’s treatise is a work of erudition, displaying his knowledge of all types of related sources on the subject, be they medical, philosophical or mathematical, dedicated explicitly to a scholarly public of both physicians and philosophers.<sup>42</sup> This is very much the case when he explains the ‘modus visionis’ in Book Two: after setting the scene, with lengthy discussions on the essential concepts involved in the process of seeing – such as *lumen* and *species* – he gives a critical overview of the different opinions held among his predecessors, mainly philosophers and opticians. He concentrates on the discussion on the ‘modus visionis’ within the *medical* world as well.<sup>43</sup> What is important here, as discussed above, is that for most of the early modern physicians – unlike Plempius himself – the key to good sight lay in the visual spirits. Only in chapter 19 does the title finally promise that we arrive at the ‘true modus visionis’, the one to which he had alluded in advance so many times. But Plempius would not be Plempius if he did not precede his exposition yet again by a

---

in Smith P.H. – Schmidt B. (eds.), *Making Knowledge in Early Modern Europe. Practices, Objects, and Texts, 1400–1800* (Chicago-London: 2007) 199–213. She argues that the category of wonder ‘helps substantially to account for the impact these collections may have had and, indeed, for the ways in which they functioned philosophically’ (213).

<sup>39</sup> See Swan, “Making Sense” 208.

<sup>40</sup> Wenzel N., “The Camera Obscura II: Images and Texts”, in Lefèvre W. (ed.), *Inside the Camera Obscura. Optics and Art under the Spell of the Projected Image* (Berlin: 2007) 13–30, 23.

<sup>41</sup> Cook, “New Philosophy” 115–149.

<sup>42</sup> See the letter to the reader in the first edition of the *Ophthalmographia*.

<sup>43</sup> Plempius, *Ophthalmographia* 73–75.

refutation of some predecessors, this time those who introduced some new elements, such as Platter. So, once more, he keeps his reader waiting until, finally, aware of the reader's increasing frustration, he directly addresses himself to them: 'But reader, in order not to keep you waiting any longer, I will now come to the true *modus [visionis]*'.<sup>44</sup>

It is necessary to place so much emphasis on the structure of the book – on all that precedes Plempius' actual introduction of the camera – because I believe that it forms an integral part of his argumentative structure. The lengthy and contradictory discussions forced the reader to realise that there was an impasse in the way of thinking on the '*modus visionis*', and made him long for a way out. When Plempius finally presents the camera, the desired effect is that of a *deus ex machina*, not only because it will serve to resolve the deadlock, but also because it is an utterly new and spectacular element, borrowed from the magical and mathematical tradition but alien to medical discourse. Without those lengthy introductory discussions, his camera would not have had the same effect.

After so many refutations and arguments, therefore, Plempius merely invites his reader to enter with him into a dark room – *camera obscura* – and to experience the marvellous spectacle: 'enter with me into the camera obscura', he simply says.<sup>45</sup> That his invitation is more than a rhetorical procedure to gain authority for his experiment, but is a genuine exhortation to repeat the experiment, is clear not only because of his insistence and the detailed instructions with which he describes the instrument, but also because of the element of wonder, which, as I will argue below, forms an essential part of his argument. He mentions many more details than are strictly necessary to understand the working of the device, and insists several times that there is no reason not to undertake the experiment: making a camera obscura takes only a little effort, it does not cost anything and the result is absolutely wonderful and spectacular.<sup>46</sup> Rather than a mere description of an event, it is a 'how-to' manual for his readers.

Plempius is aware of the difficulties that one will encounter when transforming an ordinary room into a camera obscura, and suggests in very concrete ways how to overcome them. Indeed, we should remember that the camera obscura was at first simply what its name suggests, a darkened room, although by the mid-twenties smaller portable models

<sup>44</sup> Plempius, *Ophthalmographia* 77 'Sed ne te suspendam diutius, verum modum explicare aggredior'.

<sup>45</sup> Plempius, *Ophthalmographia* 77 '... ingredere mecum obscuram hanc cameram'.

<sup>46</sup> For instance, Plempius, *Ophthalmographia* 78 'Atque haec omnia perpauilla operatum nullis sumtibus potes experiri'.

also circulated.<sup>47</sup> Plempius urges his readers to close all doors and windows well, and block any openings or cracks, so that no light at all can enter into the room. Then one should make a very small opening in the frame of the window. But one should be careful, if the wood is too thick, and open it a little with a pickaxe.<sup>48</sup> He also advises how to construct a small roof above the aperture in order to prevent too much light from entering.<sup>49</sup>

It may be surprising to find so many details, and to see a medical doctor at work with hammer and axe, but this does not seem to hinder Plempius. One gets the impression that the new type of physician that Plempius embodies no longer has an aversion towards using his hands. On the contrary, he considers this necessary in order to come to knowledge, as his involvement with anatomical dissections also proves. I would even argue that his involvement in dissecting activities constituted an important step towards the type of experimental activities we encounter here or, vice versa, that his experiments were closely linked to his anatomical activities.<sup>50</sup>

This is important from a methodological point of view: Plempius presents us with a new way of generating physiological knowledge. It is known that anatomy generated physiological knowledge.<sup>51</sup> But dissection and reflection alone were no longer enough for generating physiological knowledge: one needed to go a step further and undertake experiments. Knowledge, even knowledge about the body, had to be unravelled manually, by dissecting bodies, and had to be (re-)constructed manually, by conducting experiments. So, the generation of physiological

<sup>47</sup> See Wenzel, "Camera Obscura" 15–24.

<sup>48</sup> Plempius, *Ophthalmographia* 77 'Quod si fenestrae asser crassior sit, ita ut partes foramen circumstantes opacae quoquo modo reddantur, dolabra vel alio instrumento attenuetur, atque impedimenta auferantur, donec liber prospectus per foramen pateat ad omnes res foris existentes, quae intus sunt exhibendae ad spectaculum'.

<sup>49</sup> Plempius, *Ophthalmographia* 78 'suggrundia seu imbricamentum, foramini superaddere'.

<sup>50</sup> By the 1620s, dissecting bodies had become a common practice to investigate the body, see Park K., "The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy", *Renaissance Quarterly* 47 (1994) 1–33.

<sup>51</sup> On the link between anatomy and physiology, see especially Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800. I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665 and idem, "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.

knowledge requires a double process, one of de-construction and one of re-construction.

Plempius furthermore suggests that his reader should undertake some small experiments within their dark room in order to achieve the best image, such as to moving the paper wall backwards and forwards, and doing the same with the objects outside that one wants to see projected, in order to explore what is the best size of opening (if it is too big the image will be confused, if too small there will be insufficient light) and, above all, he advises his readers to place a convex lens in front of the opening. He explains briefly that the lens produces an *infractio* whereby the *species* are brought back together so as to obtain a clearer image ('vegetiores'). The inversion of the image, however, remains.<sup>52</sup>

That Plempius urges his readers to participate in and repeat his experiments, to experience the experiments themselves, is also interesting from a methodological point of view. Because for Plempius, to believe him – or, to put it in more scholarly terms, 'to credit him with authority' – is not enough.<sup>53</sup> The whole power of Plempius's argument lies precisely in reconstructing and undergoing the experience, as he repeats several times. He is convinced that whoever undergoes the experience will need no further demonstrations. Only by reconstructing and repeating the experiments, and exploring the conditions of image formation, thus assuming for oneself the role of wonder-maker, will one realise that there are actually no occult powers and no magic involved; except, that is, for *natural* magic.

Words cannot describe the wonder of what happens in a camera, and surely cannot produce the same effect as wonder itself. Think of the well-known letter written by Constantijn Huygens to his parents about the marvels of his camera: 'it is not possible for me to reveal the beauty to you in words'.<sup>54</sup> For contemporary readers used to pictures and movies, it might be difficult to appreciate what was so wondrous about the images in a camera obscura, but early modern men were deeply impressed by them. Apart from the repeated exclamations of Della Porta and Plempius in their publications on the subject, one only needs to consider the more disinterested testimony of Constantijn Huygens, in the letter to his parents just quoted.

<sup>52</sup> Plempius, *Ophthalmographia* 78.

<sup>53</sup> See Shapin S. – Schaffer S., *Leviathan and the Air-pump. Hobbes, Boyle and the Experimental Life* (Princeton etc.: 1985).

<sup>54</sup> Letter of April 13, 1622, quoted and translated in Wenzel, "Camera Obscura" 23.

Plempius' experiments with the camera obscura show that he was involved with experimental philosophy much earlier than his participation in the discussion on the circulation of the blood might suggest. It is not Harvey who led Plempius into (dissection) experiments: it was a method with which he had been familiar for a long time. With the conversion story, he shows himself to be the ideal reader he had in mind when writing his *Ophthalmographia*. For I want to suggest here that Plempius is attempting a new methodology not only of *generating*, but also of *presenting* physiological knowledge. The reader (the medical doctor) has to participate, to think, and to act. He cannot passively consume and accept what he reads, but has to check it for himself, as a way of assimilating, of re-constructing. Plempius, in a way, tries to re-educate his readers, from passive readers into active readers – and explorers. A telling example in relation to this occurs in Book Three, when he is explaining how the different humours and layers of the eye directly participate in the process of vision; he says, well, by now you are sufficiently well-instructed to know by yourself what will be the function. And, as a matter of fact, he then goes on to leave it up to the reader to find the answer.

*The camera obscura and the modus visionis*

After his instructions on how to build the camera and assuming that his reader has by now experienced what it is about, Plempius comes to the heart of his exposition: the *comparison* between the camera obscura and the human eye. He sums up all the parallels: the small opening corresponds to the pupil, the lens to the crystalline humour (nowadays called the lens), and the wall or paper screen to the retina, the only difference being that the screen in the eye is round, which provides an even better image. And thus, he concludes emphatically, 'just as we find a *picture* on the wall of the camera obscura, vision is made by a picture (*picturam*) of the visible things on the surface of the retina', borrowing here the Keplerian term *pictura* [Fig. 1].<sup>55</sup> This might seem obvious to us, but to Plempius's contemporaries this was far less the case. The camera was less unambiguous than we might think and was subjected to different interpretations.

<sup>55</sup> Plempius, *Ophthalmographia* 78 'visionem fieri per picturam rei visibilis in albo sub-ruso retinae cavae superficiei pariete'. On Kepler's use of the terms *pictura* and *imago*, see Dupré, "Playing with Images".



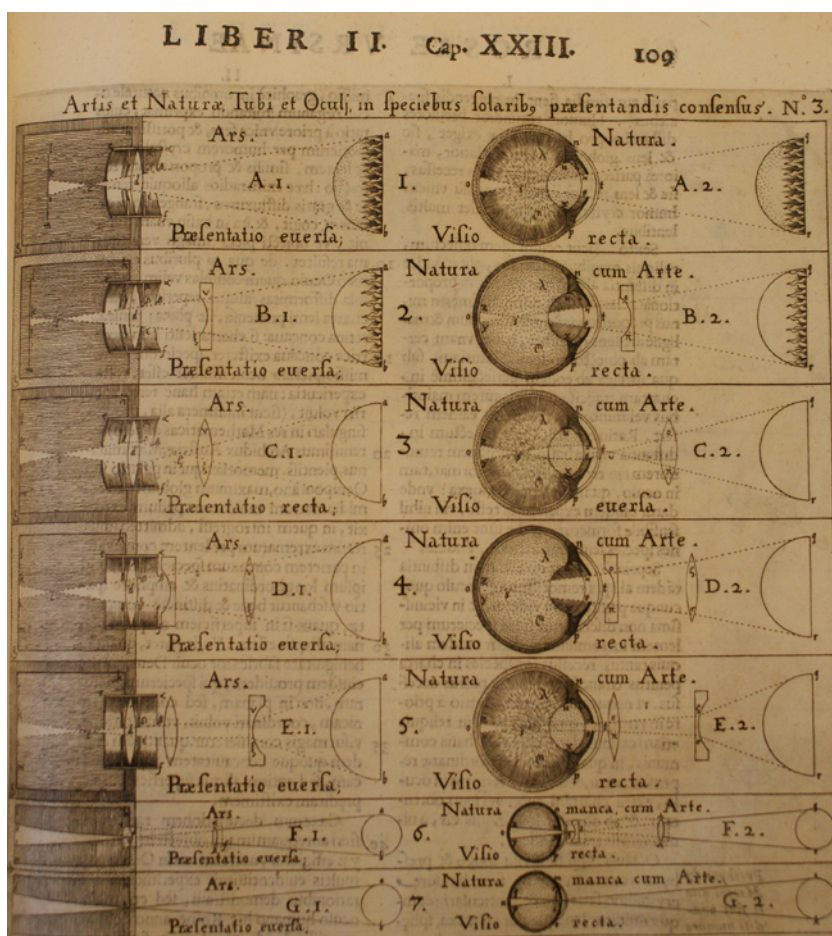


Fig. 1. Comparison between the working of an eye and a camera obscura in Christoph Scheiner, *Rosa Ursina* (Bracciano, Andreas Phaeus: 1630).

Wolfgang Lefèvre recently stressed that the conception of the eye as a camera obscura 'is a remarkable fact that should be considered in the broader context of the emerging mechanistic anatomy and physiology. As hydraulic machines served William Harvey (1578–1657) as models of the blood circulation, or as pneumatic systems served René Descartes (1596–1650) as models of enervation and muscle contraction, so the camera obscura served as a model of the eye, a model that facilitated a new understanding and further study of how vision works'.<sup>56</sup> However, it is

<sup>56</sup> Lefèvre, *Inside the Camera* 8.

important to stress that the camera as such does not deliver a new theory of vision. The meaning attributed to it and the disciplinary context in which it is appropriated can be quite different, as some examples of Plempius' predecessors prove. Della Porta, for instance, maintained that it was not the retina, but the lens, that was the actual site of projection, acting as the screen in the camera, thus supporting the widely-accepted view that the lens was the seat of vision. For him, the importance of the experiment is that it provides conclusive evidence against the extramission theory of vision. The Jesuit mathematician Christoph Scheiner, in turn, placed experiments with the camera at the core of his argument, just as Plempius had done, but clearly ascribed a different meaning to them: he adduced the camera to prove the existence of 'species'.<sup>57</sup>

In contrast to his predecessors, for Plempius the camera obscura constitutes the *ultimate proof of the process of seeing itself*. What is important here is his insight that vision happens in a fully automatic way by a projection of images, without any intervention from the body – and this, purely and simply by way of its architecture, by how it is built: a dark room with a small aperture in the front. It is as simple as this; there is no mystery, no need for further storytelling, as physicians loved to do. Any 'construction' that fulfils these basic conditions will provide the same spectacle. This was the main message he wanted his reader to receive very clearly. He leaves out the mathematical explanation and details about refraction,<sup>58</sup> in order not to be diverted from the basic and central idea for doctors: there is no intervention of spirits whatsoever – a process which we could call the 'despiritualisation' of the eye. The camera and the eye are one and the same instrument.

### *A dissection-experiment*

If the eye is a camera obscura, then we should, ideally, be able to see the image projected in the eye. Johannes Kepler had suggested something similar, but he thought it was impossible to realise.<sup>59</sup> As an experienced anatomist, Plempius showed it was possible and, once again, urged his

<sup>57</sup> Scheiner, *Oculus* 125–128. On Scheiner's use of the concept 'species' and how he relied on the camera to attribute meaning to it, see Pantin I., 'Simulachrum, Species, Forma, Imago. What was Transported by Light into the Camera Obscura? Divergent Conceptions of Realism Revealed by Lexical Ambiguities at the Beginning of the Seventeenth Century', *Early Science and Medicine* 13 (2008) 245–269.

<sup>58</sup> While he gives some mathematical details on refraction in another part of his book, at this point, he only wants to get straight to the main idea.

<sup>59</sup> Kepler, *Paralipomena* 170.

readers to undertake the experiment for themselves. Take the eye of a freshly slaughtered ox and cut away very carefully the layers (*tunicas*) at the optic nerve until the vitreous humour becomes visible, he says. But be careful that the fluids do not flow out. Cover the back of the eye with a thin piece of paper or with the membrane from an egg, and place the eye as such in the opening of the camera obscura, at the place where the light enters. Then, with you yourself standing in the camera obscura behind the eye, you will perceive on the back a picture that represents in a perfect way all objects of the world outside.<sup>60</sup> The famous depiction of this experiment may be seen in Descartes' *Discours de la méthode* [Fig. 2].<sup>61</sup>

This is really the key moment in Plempius' exposition, because the dead eye – even more than the camera itself – provides, paradoxically, a kind of living proof for the fact that the eye can function as an autonomous instrument, with no need for the body and its spirits. In a dead eye, there are no spirits but, nonetheless, the image appears. This idea plainly contradicts the current belief amongst physicians that visual spirits were essential in the process of vision. For almost all physicians – even those who believed in intromission – ascribed to the spirits an active role in the process of seeing. The experiment also proves that vision takes place at the back of the eye, in the retina, and not in the crystalline humour, again contradicting the current belief amongst physicians.

Similar experiments had been carried out by Christoph Scheiner some years before, and were known to Plempius.<sup>62</sup> However, again, the context was different, and the meaning he attributed to it was also different. Scheiner was interested in image formation itself, in the behaviour of light in its way throughout the eye, but not in relation to the body. For Scheiner, the importance of the experiment with the dead eye lies in the fact that light rays cross, that inversion takes place, and that image formation takes

<sup>60</sup> Plempius, *Ophthalmographia* 79 'Cape oculum bovis recens mactati, et in fundo ad nervum opticum dextre tunicas aufer, ut magnam portionem humoris vitrei detegas, sic tamen, ut nihil ejus effundatur: dein vitreum rursus papyro aut pellicula ovi tegito, atque oculum si fenestras foramini imponito e regione objectorum illuminatorum. Tu igitur stans in cubiculo illo obscurato retro oculum, videbis picturam perfectissime omnia objecta repraesentantem'.

<sup>61</sup> It is probably no coincidence that Descartes describes the same experiment in strikingly similar terms in his *Discours de la méthode*. I do believe that Plempius's ideas on vision were developed in close connection with Descartes. For details and arguments, see Vanagt K., *De emancipatie van het oog. V.F. Plempius' Ophthalmographia en de vroegmoderne medische denkbeelden over het zien* (S.l.: 2010).

<sup>62</sup> Scheiner referred to this experiment in his *Rosa Ursina* (Rome, Andreas Phaeus: 1630) 110.

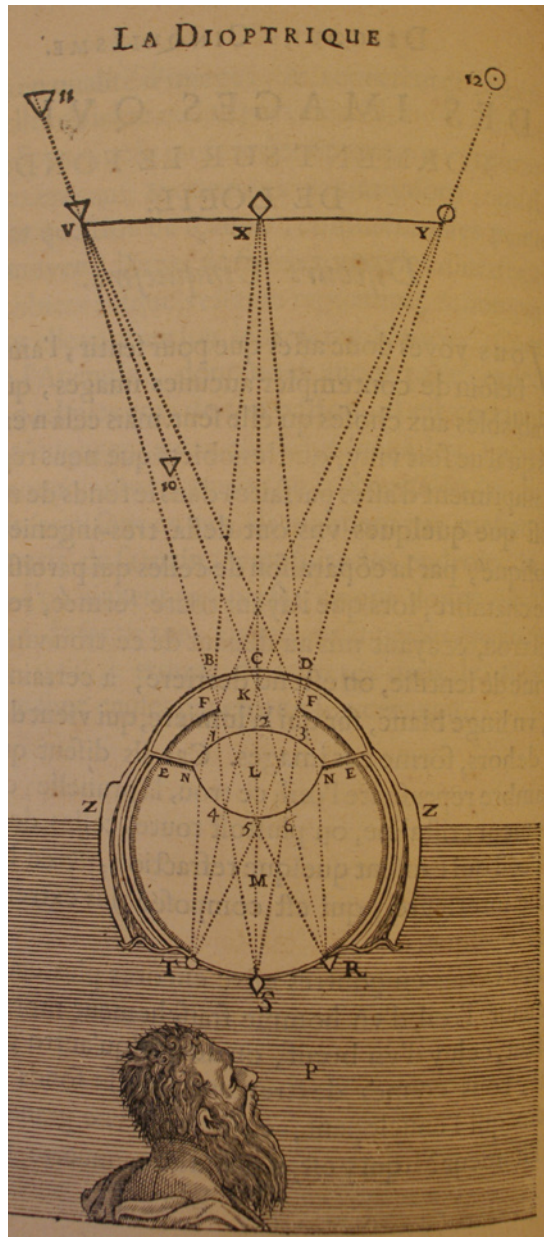


Fig. 2. Illustration of the dissection-experiment. A man standing in a camera obscura is looking at the image of an object projected on the back wall (i.e. the retina) of a carefully dissected eye, placed in the opening of the camera in René Descartes, *Discours de la Méthode* (Leiden, Jan Maire: 1637).

place on the retina. Plempius, on the other hand, realises that much more is at stake than settling the question of intromission and the seat of vision; what is crucial here is the idea of a *fully automatic* projection. Unlike his mathematical predecessors, as a physician raised within a holistic medical tradition, he fully appreciates the meaning of this disembodied eye. By dissociating the working of the eye from that of the body, he touched upon the essence of medical thinking. As a philosopher, Plempius was aware of the epistemological meaning of the device.

### *Conclusion*

Plempius' despiritualised view of the eye, and his reliance on instruments and experiments borrowed from the magical and mathematical traditions, did not imply a radical break with the classical heritage. Like his fellow physicians, Plempius was eager to place his ideas within the classical tradition and deliberately chose to follow in the footsteps of Aristotle. If Galen was explicitly dismissed and made the object of ridicule by Plempius, Aristotle was venerated more strongly than ever. Plempius took great pains to present the Keplerian theory of vision as a logical outcome of Aristotle's ideas. This is a remarkable fact, even more since we know that Kepler insisted how far Aristotle's theory of light and vision was from his own in nearly all particulars, as he himself claims.<sup>63</sup> Kepler, however, rightly suspected that Aristotelians would find a way to save their master.<sup>64</sup>

The consequences of these new insights into vision turn out to be fundamental for Plempius's ideas about the diseased eye and were to give a new direction to his therapy. An analysis of the final book of the *Ophthalmographia* reveals that Plempius's theory found a counterpart in the practice of medicine, or at least in his ideas about the practice of medicine: he re-thought the different problems with vision in accordance with his new theory and formulated therapeutic advice that would not contradict them, leaving out most of the traditional advice concerning one's way of life.<sup>65</sup> Maybe the most telling example of this is his changing attitude towards

---

<sup>63</sup> Kepler, *Paralipomena* 29–37.

<sup>64</sup> Kepler, *Paralipomena* 37.

<sup>65</sup> For an analysis of Plempius's ideas on ocular diseases and therapy, see Vanagt, *De emancipatie van het oog*.

eyeglasses: only with the insight into the eye as a real camera obscura, where the visual image is formed without the aid of visual spirits, could physicians fully accept the use of eyeglasses and include them in their therapies as the *only* remedy for problems with diminished vision.<sup>66</sup>

---

<sup>66</sup> On the difficulty of giving eyeglasses a place within medical discourse, see Vanagt, "Suspicious Spectacles".



*Selective bibliography*

- ARMOGATHE J.-R., "The Rainbow: A Privileged Epistemological Model", in Gaukroger S. – Schuster J. – Sutton J. (eds.), *Descartes' Natural Philosophy* (London-New York: 2002) 249–257.
- BLOCH O.R., *La philosophie de Gassendi. Nominalisme, matérialisme et métaphysique*, Archives Internationales d'Histoire des Idées 38 (The Hague: 1971).
- BOUDON-MILLOT V., "Vision and Vision Disorders: Galen's Physiology of Sight", in Horstmannshoff M. – King H. – Zittel C. (eds.), *Blood, Sweat and Tears. The Changing Concepts of Physiology from Antiquity into Early Modern Europe* Intersections 21 (Leiden: 2011) 551–567.
- CABROLIUS BARTHOLOMAEUS, *Ontleeding des menschelycken lichaems*, tr. Plempius V.F. (Amsterdam, Hendrick Laurensz.: 1633).
- CAPIVACCIO GIROLAMO, *Opera omnia*: ed. Hartmannus J. (Frankfurt, E. Paltheniana-Iona Rodius: 1603).
- CASSERIUS JULIUS, *Pentaestheseion* (Venice, Nicolaus Misserinus: 1609).
- COOK H.J., *Matters of Exchange. Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven-London: 2008).
- , "The New Philosophy in the Low Countries", in Porter R. – Mikulás (eds.), *The Scientific Revolution in National Context* (Cambridge: 1992).
- CUNNINGHAM A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- , "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 II: Old Anatomy – The Sword", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003) 51–76.
- DASTON L. – PARK K., *Wonders and the Order of Nature, 1150–1750* (New York: 1998).
- DEAR P., *Discipline and Experience* (Chicago-London: 1995).
- DUPRÉ S., "Playing with Images in a Dark Room: Keplers' *Ludi* inside the Camera Obscura", in Lefèvre W. (ed.), *Inside the Camera Obscura. Optics and Art under the Spell of the Projected Image*, Max-Planck-Institut für Wissenschaftsgeschichte Preprint 333 (Berlin: 2007) 59–74.
- EAMON W., *Science and the Secrets of Nature, Books of Secrets in Medieval and Early Modern Culture* (Princeton-New Jersey: 1999).
- FABRICIUS AB AQUAPENDENTE HIERONYMUS, *De visione, voce, auditu* (Venice, Franciscus Bolzetta: 1600).
- FINDLEN P., "Jokes of Nature and Jokes of Knowledge: The Playfulness of Scientific Discourse in Early Modern Europe", *Renaissance Quarterly* 43 (1990) 292–331.
- FRENCH R., *Medicine before Science. The Rational and Learned Doctor from the Middle Ages to the Enlightenment* (Cambridge: 2003).
- , *William Harvey's Natural Philosophy* (Cambridge: 1994).
- GREENE M., "The Heart and Blood: Harvey, Descartes and Plemp", in Voss S. (ed.), *Essays on the Philosophy and Science of René Descartes* (Oxford: 1993) 324–336.
- HAMMOND J.H., *The Camera Obscura. A Chronicle* (Bristol: 1981).
- HARVEY E.R., *The Inward Wits. Psychological Theory in the Middle Ages and the Renaissance* (London: 1975).
- HEURNIUS JOHANNES, *De morbis oculorum, aurium, nasi, dentium et oris* (Leiden, Raphelengius: 1608).



- KEPLER JOHANNES, *Ad Vitellionem paralipomena quibus astronomiae pars opticae traditur* (Frankfurt, Claudius Marnius and Haeredes Ioannis Aubrius: 1604).
- LAURENTIUS ANDREAS, *Historia anatomica corporis humani* (Frankfurt, Matthaeus Beckerus: ca. 1599).
- LEFÈVRE W. (ed.), *Inside the Camera Obscura – Optics and Art under the Spell of the Projected Image*, Max-Planck-Institut für Wissenschaftsgeschichte Preprint 333 (Berlin: 2007).
- LINDBERG D.C., *Theories of Vision from al-Kindi to Kepler* (Chicago-London: 1976).
- LINDEBOOM G.A., *Descartes and Medicine, Nieuwe Nederlandse bijdragen tot de geschiedenis der geneeskunde* 1 (Amsterdam: 1979).
- , *Dutch Medical Biography. A Biographical Dictionary of Dutch Physicians and Surgeons 1475–1975* (Amsterdam: 1984).
- MONCHAMP G., *Histoire du Cartésianisme en Belgique, Mémoires couronnés et autres mémoires* 39 (Brussels: 1886).
- PANTIN I., “Simulachrum, Species, Forma, Imago: What was transported by Light into the Camera Obscura? Divergent conceptions of Realism revealed by Lexical Ambiguities at the Beginning of the Seventeenth Century”, *Early Science and Medicine* 13 (2008) 245–269.
- PARK K., “The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy”, *Renaissance Quarterly* 47 (1994) 1–33.
- PLATTER FELIX, *De corporis humani structura et usu. libri III* (Basel, Ambrosius Frob.: 1583).
- PLEMPIUS VOPISCUS FORTUNATUS, *Ophthalmographia, sive tractatio De oculi fabrica, actione et usu praeter vulgatas hactenas, philosophorum ac medicorum opiniones* (Amsterdam, Hendrick Laurensz.: 1648).
- , *Verhandelinge der spieren* (Amsterdam, Iacob Aerts: 1630).
- PORTA GIAMBATTISTA DELLA, *Natural Magick* (London, Thomas Young and Samuel Speed: 1658).
- SCHNEIDER CHRISTOPH, *Oculus, hoc est fundamentum opticum* (Innsbruck, Daniele Agricola: 1619).
- , *Rosa Ursina* (Bracciano, Andreas Phaeus: 1630).
- SCHMITT C.B., *Aristotle and the Renaissance* (Cambridge, MA: 1983).
- SHAPIN S. – SCHAFER S., *Leviathan and the Air-pump. Hobbes, Boyle and the Experimental Life* (Princeton e.a.: 1985).
- SIMON G., *Sciences et Savoirs aux XVI<sup>e</sup> et XVII<sup>e</sup> siècles*, Histoire des sciences (Lille: 1996).
- SWAN C., “Making Sense of Medical Collections in Early Modern Holland: The Uses of Wonder”, in Smith P.H. – Schmidt B. (eds.), *Making Knowledge in Early Modern Europe. Practices, Objects, and Texts, 1400–1800* (Chicago-London: 2007) 199–231.
- TRICOT J.P., “Vopiscus Fortunatus Plempius”, *Vesalius* 6 (2000) 11–19.
- VANAGT K., *De emancipatie van het oog. V.F. Plempius’ Ophthalmographia en de vroegmoderne medische denkbeelden over het zien* (S.l.: 2010).
- , “‘Hoe men zich voor brillen behoeden kan’ of de moeizame verspreiding van optische kennis in vroegmoderne medische kringen”, *Gewina* 29 (2006) 26–40.
- , “Suspicious Spectacles. Medical Perspectives on Eyeglasses, the Case of Hieronymus Mercurialis”, in Helden A. van – Dupré S. – Gent R. van – Zuidervaart H. (eds.), *The Origins of the Telescope*, History of Science and Scholarship in the Netherlands 12 (Amsterdam: 2010) 115–129.
- WENZEL N., “The Camera Obscura II: Images and Texts”, in Lefèvre W. (ed.), *Inside the Camera Obscura – Optics and Art under the Spell of the Projected Image*, Max-Planck-Institut für Wissenschaftsgeschichte Preprint 333 (Berlin: 2007) 13–30.



THE *TERTIUM COMPARATIONIS* OF THE *ELEMENTA PHYSIOLOGIAE* –  
JOHANN GOTTFRIED VON HERDER'S CONCEPTION OF  
“TEARS” AS MEDIATORS BETWEEN THE SUBLIME AND  
THE ACTUAL BODILY PHYSIOLOGY

Frank W. Stahnisch

*Summary\**

It has been consistently pointed out in the research literature that his own experience of interminable suffering would have led Johann Gottfried von Herder (1744–1803) to develop ‘premature religious leanings’ during his later childhood and early adolescence. But it is less well known that Herder’s university studies had first taken him to the Medical Faculty of Königsberg, where he sought to gather knowledge about his own illness and possible remedies. Because he could not cope with the circumstances of the dissection course, he had to abandon his classes in medicine and instead changed to studying theology and philosophy. As Herder’s unpublished *Blue Book* shows, he closely followed Immanuel Kant’s (1724–1804) exposé of the mathematical and physical sciences and developed his own interpretations on contemporary physiology – notably of Albrecht von Haller’s (1708–1777) *Elementa physiologiae* – to which Herder juxtaposed his own considerations of the meaning of ‘tears’ for the human condition.

*Introduction*

The internal history of the scientific discipline of physiology – that is, the concept-oriented as well as institution-focused historical scholarship – has already attracted considerable attention.<sup>1</sup> The detailed cultural picture,

---

\* I am grateful to Helen King and Manfred Horstmannshoff for their valuable comments on the NIAS conference-version of this paper, for providing additional reading materials on the topic and for their experienced editorial hands. I also like to thank the two anonymous referees who read the submitted manuscript for Brill and made very helpful suggestions, as well as Peter Toohey for further intriguing thoughts on the final version of this paper. Last but not least, I wish to thank Beth Cusitar for her thorough revision and editing of the English language of the manuscript.

<sup>1</sup> See, among others, Foster M., *Lectures on the History of Physiology during the Sixteenth, Seventeenth and Eighteenth Centuries* (Cambridge: 1907); Canguilhem G., *La formation du concept de réflexe aux XVII<sup>e</sup> et XVIII<sup>e</sup> siècles* (Paris: 1955); Hall T.S., *Ideas of Life and Matter* (Chicago: 1969); Rothsschuh K.E., *History of Physiology* (Huntington, NY: 1973);

encompassing physiological theories, academic practices and lay assumptions, has however appeared as a research subject so far only in a very limited sense.<sup>2</sup> This gap becomes even more visible when early modern developments in physiology are taken into account. Most of the current scholarship has focused on the nineteenth and twentieth centuries, when experimental physiology emerged on the scene as the most innovative discipline in biomedicine. Everyone wanted to be physiological – that is, scientific (*wissenschaftlich*).<sup>3</sup> However, when we follow the term back into the Early Modern period, as the present chapter intends to do, we find many more, and very different, meanings of ‘physiology’.<sup>4</sup> I shall take the German theologian, philosopher and polymath Johann Gottfried von Herder (1744–1803) as my case study.<sup>5</sup> As I will show, ancient concepts of physiology were much alive in public and scientific discussions of the

---

Schiller J., *Physiologie et classification. Relations historiques* (Paris: 1980) and the contribution of V. Nutton in this volume, 27–40.

<sup>2</sup> Notable exceptions, for example, are: Lesch J.E., *Science and Medicine in France. The Emergence of Experimental Physiology, 1790–1855* (Cambridge: 1984); Coleman W. – Holmes F.L. (eds.), *The Investigative Enterprise. Experimental Physiology in Nineteenth-Century Medicine* (Berkeley: 1988); Sarasin P., *Reizbare Maschinen. Eine Geschichte des Körpers 1765–1914* (Frankfurt: 2001); Stahnisch F., *Ideas in Action. Der Funktionsbegriff und seine methodologische Rolle im Forschungsprogramm des Experimentalphysiologen François Magendie (1783–1855)* (Münster-Hamburg-London: 2003) and Schmidgen H. – Geimer P. – Dierig S. (eds.), *Kultur im Experiment* (Berlin: 2004).

<sup>3</sup> See also: Bates D., “Why not call Modern Medicine ‘Alternative’?”, *Perspectives in Biology and Medicine* 43 (2000) 502–518.

<sup>4</sup> On the succession of empirical models see: Duchesneau F., *La physiologie des lumières. Empirisme, modèles et théories* (The Hague: 1982), on the century-long structure and function debate: Debru C. (ed.), *Essays in the History of the Physiological Sciences* (Amsterdam-Atlanta GA: 1995), and for the experimental tradition in physiology, see: Tansey E.M., “The Physiological Tradition”, in Bynum W.F. – Porter R. (eds.), *Companion Encyclopaedia of the History of Medicine* (London-New York: 1996) 120–152. An overview of major topics in Early Modern Physiology and their cultural impact is given in: Rousseau G.S., “Nerves, Spirits, and Fibres: Towards Defining the Origins of Sensibility”, in Brissenden R.F. – Eade J.C. (eds.), *Studies in the Eighteenth Century, vol. III, Papers presented at the Third David Nichol Smith Memorial Seminar, Canberra 1973* (Toronto: 1973) 137–157; Rousseau G.S. (ed.), *The Languages of Psyche. Mind and Body in Enlightenment Thought* (Berkeley-Los Angeles-Oxford: 1990).

<sup>5</sup> Herder’s interest in physiology has been explored from three directions: Erna Lesky focused on Herder’s preoccupation with the brain sciences: Lesky E., “Gall und Herder”, *Clio Medica* 2 (1967) 85–96, Wolfgang Pross traced Herder’s reception of Haller’s theory of the physiological forces: Pross W., “Herders Konzept der organischen Kräfte und die Wirkung der Ideen zur Philosophie der Geschichte der Menschheit auf Carl Friedrich Kielmeyer”, in Kanz K.T. (ed.), *Philosophie des Organischen in der Goethezeit. Studien zu Werk und Wirkung des Naturforschers Carl Friedrich Kielmeyer (1765–1844)* (Stuttgart: 1994) 81–99 and Michael Hagner has investigated Herder’s combination of physiological and anthropological writings: Hagner M., “The Soul and the Brain between Anatomy and Naturphilosophie in the Early Nineteenth Century”, *Medical History* 36 (1992) 1–33.

early Enlightenment.<sup>6</sup> Nevertheless, their meanings and the analogical models themselves had already acquired very different connotations from those expounded in the physiology of Aristotle (384–322 BC) or Galen (129–200/216 AD), in comparison with Herder's representations of the term. Yet Herder's views should by no means be neglected as those of a physiological, eclectic 'layman', because as a major cultural philosopher, a medically-learned correspondent with natural historians, and a fervent critic of various learned journals and *Blätter*,<sup>7</sup> he exerted an enormous influence on the general culture of his contemporaries.<sup>8</sup>

Herder's views on contemporary physiology will be scrutinised here by paying special attention to the subject of 'tears'.<sup>9</sup> It has frequently been pointed out that Herder's concern with subjects from medicine and illness came from his own experience of chronic personal suffering. It was argued, for example, that his personal biographical background determined his 'premature religious leanings' during his later childhood and adolescence, as well as his preoccupation with a pastoral theory of suffering.<sup>10</sup> It has gone almost unnoticed, however, that Herder's first university studies took him to the Faculty of Medicine at Königsberg (East-Prussia) where he tried – not untypically for doctors in the long history of medicine – to gain more knowledge about his own illness. However, the thin-skinned student from Mohrungen (which is today Morąg, in Poland) found himself incapable of coping with the atrocious circumstances of the anatomical dissection course: he fainted and passed out while witnessing his first dissection of a human body. As a consequence, Herder dropped his medical courses after the first year and changed to the study of theology and philosophy, being one of the famous pupils of Immanuel

<sup>6</sup> See also: Craik E., *The Hippocratic Treatise On Glands* (Leiden: 2009) 11–13.

<sup>7</sup> Stahnisch F., "Herders 'anthropologische Physiologie' und die 'Hallesche Psychomedizin': Zum Verhältnis von Körpervorstellung, Religion und Therapie im 18. Jahrhundert", in Sträter U. – Lehmann H. – Müller-Bahlke T. – Soboth C. – Wallmann J. (eds.), *Die 'Neue Kreatur'. Pietismus und Anthropologie. Interdisziplinäre Pietismusforschungen. Beiträge zum Zweiten Internationalen Kongress für Pietismusforschung 2005* (Tübingen: 2009) 821–834.

<sup>8</sup> Zaremba M., *Johann Gottfried Herder. Prediger der Humanität* (Cologne: 2002) 159–186.

<sup>9</sup> See also the introduction to the present volume.

<sup>10</sup> Eva Schmidt, for example, deliberately included this interpretation from the obituary of the Weimar reform educator Johannes Daniel Falk (1768–1826) in her anthology on Herder's theological legacy: Falk J., "Weimar, Montag Nachmittags d. 19. Dzbr. 1803", in Schmidt E. (ed.), *Herder im geistlichen Amt. Untersuchungen / Quellen / Dokumente* (Leipzig: 1956) 265–268, esp. 267. Haym R., *Herder nach seinem Leben und seinen Werken dargestellt* (Berlin: 1954<sup>2</sup>), vol. 1, 6f. and Zaremba, "Prediger der Humanität" 23–26 have largely followed this perspective on Herder's theological and philosophical intentions in their biographical accounts.

Kant.<sup>11</sup> Also in this period, he held a continuing interest in biology and observed the recent progress made in surgery and medical sciences.<sup>12</sup> As is reflected in his still unpublished *Blue Book* – fittingly entitled ‘Ascetic Things’ (*Ascetische Sachen*)<sup>13</sup> – which he wrote in around 1762–1766 and which became famous after his death, Herder went beyond Kant’s exposé of mathematical and physical science. Over and above this, he introduced his personal readings of the physiologists – notably, Albrecht von Haller’s *Elementa physiologiae corporis humani* (1757–1766)<sup>14</sup> – which he linked to his own considerations of physical science and to theological, as well as anthropological, meanings of ‘tears’. This is accurately reflected in many of Herder’s writings, poems and sermons, where he deliberately introduced his own experiences and perceptions, comparing them to the current state of physiological knowledge.<sup>15</sup>

By drawing on Herder’s own publications, unpublished notes and contemporary sources on physiological theory and medical practice, this article aims to map out the local context of the development of Herder’s views about the physiology of tears at the cross-roads of personal suffering, intellectual and theological interests. As will become apparent later in this article, the physiological problem of ‘tears’ emerges in specific periods, and it attracts different levels of public and academic attention. While some earlier discussions did situate themselves in relation to the distant past – and Herder’s physiological terminology reflects this – the interpretation of physiology in general, and tears in particular, should be seen as undergoing qualitative breaks with those trends that derived from the Early Modern period and especially those that traced their roots to ancient Greek and Roman medicine.<sup>16</sup> While my focus here is on such changing

<sup>11</sup> Nisbet H.B., “Naturgeschichte und Humangeschichte bei Goethe, Herder und Kant”, in Matussek P. (ed.), *Goethe und die Verzeitlichung der Natur* (Munich: 1998) 15–43.

<sup>12</sup> Zaremba, “Prediger der Humanität” 34.

<sup>13</sup> Bound in a blue cover, Herder’s so-called ‘Blue Study Book’ consists of handwritten notices on natural history and philosophical metaphysics from his university time at Königsberg between 1762 and 1766 (Capsule XX; AHN (*Abteilung für Handschriften und Nachlässe*); it is kept in the Manuscript and Incunabula Collection of the Berlin State Library; Culture Forum).

<sup>14</sup> Cf. Haller Albrecht von, *Anfangsgründe der Physiologie des menschlichen Körpers* (Berlin, Christian Friedrich Voss: 1762).

<sup>15</sup> See, for example, in: Stahnisch F., “‘Dieu et cerveau, rien que Dieu et cerveau’: Johann Gottfried von Herder (1744–1803) und die Neurowissenschaften seiner Zeit”, *Würzburger medizinhistorische Mitteilungen* 26 (2007) 124–165.

<sup>16</sup> Cf. Edelstein L., “The Relation of Ancient Philosophy to Medicine”, in Temkin O. – Temkin C.L. (eds.), *Ancient Medicine. Selected Papers of Ludwig Edelstein* (Baltimore: 1967) 349–366, and more recently: Fögen T., “Tears and Crying in Graeco-Roman Antiquity: An Introduction”, in Fögen T. (ed.), *Tears in the Graeco-Roman World* (Berlin: 2009) 1–16.

terminology, with technical terms being re-interpreted in ordinary language and philosophical analyses given theological underpinnings, a new approach to 'Herder's physiology' can also help us reach a better understanding of the advances in history of physiology more generally. The German polymath Johann Gottfried von Herder represents an extraordinary example of a learned individual whose personal life and intellectual work touched upon, if not centred on, an enduring occupation with understanding the meaning of tears and crying for the human condition.<sup>17</sup> The current case study offers a new and local interpretation of the broader picture of 'physiology', but not understood as *the* central discipline, since this term was still problematic in the eighteenth century.<sup>18</sup> Instead, together with all the repercussions existing between physiological research, scholarly interest and *the individual experience of health and illness*, it should be viewed as the 'prime mover' for the preoccupation with physiology.<sup>19</sup> This occurred not only among lay people but also in this professional eighteenth-century philosopher who then acted as an important mediator for physiological concepts among his contemporaries.

In the historical scholarship, there is a remarkable discrepancy with respect to the knowledge available about Herder's professional roles: while there is plenty of literature on the 'Weimar theologian',<sup>20</sup> the 'school reformer'<sup>21</sup> and 'Superintendent General'<sup>22</sup> of the Principedom of Saxony-Weimar, there is much less on his achievements in cultural anthropology, general philosophy and, above all, on Herder as a prolific interpreter of the biological and physiological sciences.<sup>23</sup> Despite this imbalance in research on Herder, I want to convey an image of him as a supreme scholar, book

<sup>17</sup> See, for example, Minter C.J., "Literary 'Empfindsamkeit' and Nervous Sensibility in Eighteenth-Century Germany", *The Modern Language Review* 96 (2001) 1016–1028, esp. 1021–1024.

<sup>18</sup> Cf. Duchesneau, "La physiologie des lumières" 141–170.

<sup>19</sup> On the issue of great philosophers' and scholars' interest in medicine, as grounded in their own illness, see Frank A.W., *The Renewal of Generosity. Illness, Medicine, and How to Live* (Chicago: 2004) 3–9 and Charon R., "Bearing Witness: Sontag and the Body", *New England Journal of Medicine* 352 (2005) 756.

<sup>20</sup> Köpke W., "Truth and Revelation: On Herder's Theological Writings", in Köpke W. – Kroll S.B. (eds.), *Johann Gottfried Herder. Innovator through the Ages* (Bonn: 1982) 140–159.

<sup>21</sup> Owren H., *Herders Bildungsprogramm und seine Auswirkungen im 18. und 19. Jahrhundert* (Heidelberg: 1985).

<sup>22</sup> Kessler M., *Johann Gottfried Herder, der Theologe unter den Klassikern. Das Amt des General-Superintendenten von Sachsen-Weimar* (Berlin-New York: 2007).

<sup>23</sup> The most comprehensive studies of the relation between Herder's anthropological and philosophical works have been published by Nisbet H.B., *Herder and the Philosophy and History of Science* (Cambridge: 1970) and Pross W. (ed.), *Johann Gottfried Herder. Werke* (Munich: 1984–2002).



collector and influential populariser of contemporary medicine and natural history; an activity situated in a particular local and personal context. From his student days, he continued to communicate with leading academics and learned natural historians and later became a frequent guest at natural history events at the University of Jena, rising to be a co-founding member of its Society for Natural History and Science [Fig. 1].<sup>24</sup>

During this early period, and also in his later years at Weimar, Herder frequently corresponded with cutting-edge scholars, natural historians and contemporary physicians, a list of whom reads like the 'Who's Who of eighteenth-century European science': the Swiss reformed theologian Johann Caspar Lavater (1741–1801),<sup>25</sup> who developed his physiognomic doctrine into a comprehensive research programme on psychological character analysis, or Samuel Thomas von Sömmerring (1755–1830) of Mainz,<sup>26</sup> whose leading brain and nerve morphology Herder evaluated strongly. Sömmerring's doctrine was based on the assumption that human neuroanatomy displayed functionally organised localizable centres, and further held that nerve actions were the result of the exchange of 'nervous fluid' between individual nerve sheets, functionally related brain parts as well as the integrative action (*sensus communis*) of the brain's ventricles.<sup>27</sup> Other correspondents included Haller's pupil, the physician Johann Georg von Zimmermann (1728–1795) in Hannover,<sup>28</sup> who acted as an important populariser of his mentor's theory of irritability and sensibility as well as of empirically oriented medical practice, and the young Christoph Wilhelm Hufeland (1762–1838),<sup>29</sup> who was Herder's own family physician in Weimar. In addition, as a twenty-one year old Strasbourg student Herder

<sup>24</sup> Stahnisch, "Herder und die Neurowissenschaften" 128f.

<sup>25</sup> Dünzer H. – Herder F.G. von (eds.), *Aus Herders Nachlass, ungedruckte Briefe von Herder und dessen Gattin, Goethe, Schiller, Klopstock, Lenz, Jean Paul, Claudius, Lavater, Jacobi und andern bedeutenden Zeitgenossen* (Frankfurt: 1857), vol. 2, 10–209.

<sup>26</sup> See, for example, Herder's letter to Sömmerring on February 28th, 1785, in which he discusses Haller's physiological theory of nerve action and asks for Sömmerring's judgement: Dobbek W. (ed.), *Herders Briefe* (Weimar: 1959) 249–250.

<sup>27</sup> This interpretation relates back to Aristotle's introduction of the '*sensus communis*' as a particular disposition of the *psychê*, which is shared by all human beings and responsible for connecting the impressions from the individual sense organs within a coherent and intelligible representation. See, in particular, Aristoteles, *De anima* 1, 1–2, 402a–402b (Aristotle, *De Anima* (Über die Seele), in Karsch A. (ed.), *III. Schriften zur Naturphilosophie* (Stuttgart: 1847), vol. 1, 1–2). See also the contributions by Kodera 143 n. 14 and Bidwell-Steiner 666–667 in this volume.

<sup>28</sup> Cf. Bonin D., *Johann Georg Zimmermann u. Johann Gottfried Herder nach bisher ungedruckten Briefen* (s.n.: 1910).

<sup>29</sup> See, for example, Gesche A., *Sprache und die Natur des Menschen* (Würzburg: 1993) 93f.

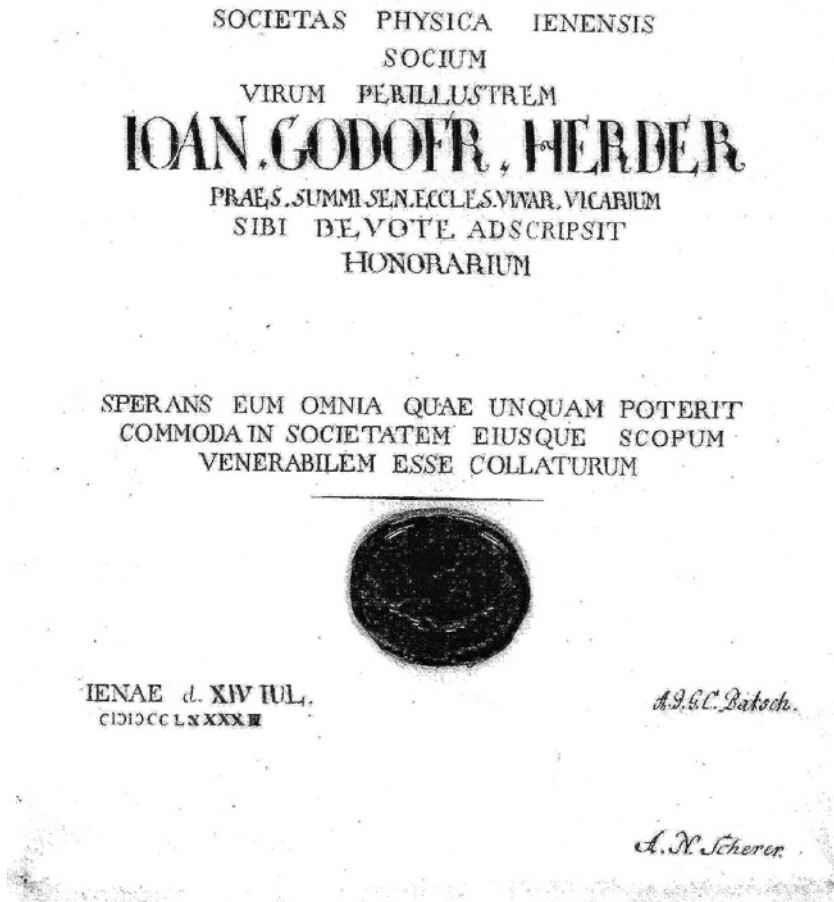


Fig. 1. Johann Gottfried von Herder, *Certificate from the Society for Natural History and Science*, 1793.

met Johann Wolfgang von Goethe (1749–1832),<sup>30</sup> having been deeply influenced by him as well due to his wider biological and geological interests. As a result of Goethe's proximity with Prince Carl August (1792–1862), Herder received the influential position of theologian in the vibrant cultural centre of Weimar,<sup>31</sup> and this friendship with Goethe would continue until his death.

<sup>30</sup> Hahn K.-H., *Briefe an Goethe. Gesamtausgabe in Regestform* (Weimar: 1981) 164.

<sup>31</sup> Ebersbach V., *Carl August. Goethes Herzog und Freund* (Cologne: 1998) 101–103.

As I have already suggested, it was in Herder's student years in particular that his later interests in medicine and the natural sciences emerged. I shall now consider these in more detail. Looking at Herder's inaugural lecture of 1765 as a new Instructor of the Cathedral School in Riga (Latvia), Maryland-based literary scholar Simon Richter has strikingly mapped the impressive multi-layered interests of this early-Enlightenment polymath.<sup>32</sup> From his early years in Königsberg and the school appointment in Riga, Herder taught and read widely in natural history, geography, European history, mathematics, French language and culture, rhetoric and philosophy. His knowledge and expertise in theology, the ancient languages and ancient history went far beyond what could have been expected from a contemporary clergyman. What he charmingly said about Haller's learned attitude, when he spoke about the latter's 'heavy weight of the [Bernese] Alps on his learned shoulders' (*die Alpenlast der Gelehrsamkeit auf seinen Schultern*), also held true for Herder himself.<sup>33</sup> The thematic *intersections*<sup>34</sup> between natural history, philosophy and areas of aesthetics were a direct expression of Herder's urge to transcend and question discrete subject boundaries.<sup>35</sup> This tendency to blend together different fields of knowledge also emerged later in his reflections on contemporary physiological assumptions and, in particular, in his discussion of the 'irritability'<sup>36</sup> of the bodily organs – a concept also central for apprehending the status of 'tears' in Herder's thought. As the medical historian Richard Töllner has pointed out, Haller's example of the inherent vital and irritable disposition of the muscle fibres to act similarly serves the characterisation of Herder's views on the physiology of the tear glands: 'In Haller, irritability of the soul was one of the major traits of the discoverer of "irritability's" own character'.<sup>37</sup>

Interestingly, past research in medical history has not addressed the question of how suffering might have influenced and changed the intellectual views of this great philosopher and theologian, and investigations

<sup>32</sup> Richter S., "Medizinischer und ästhetischer Diskurs im 18. Jahrhundert: Herder und Haller über Reiz", *Lessing Yearbook* 25 (1993) 83–95.

<sup>33</sup> Herder J.G. von, "Briefe zur Beförderung der Humanität, Achte Sammlung", in Suphan B. (ed.), *Sämtliche Werke* (Berlin: 1883) 116.

<sup>34</sup> This is of course also the title of the series in which this volume appears.

<sup>35</sup> Richter, "Medizinischer und ästhetischer Diskurs" 85–87.

<sup>36</sup> Cf. Pross W., "Haller und die Aufklärung", in Steinke H. – Boschung U. – Pross W. (eds.), *Albrecht von Haller. Leben. Werk. Epoche* (Göttingen: 2008) 415–460, esp. 441–448.

<sup>37</sup> Töllner R., "Zur Deutung der 'Fragmente Religiöser Empfindungen'", in Steinke H. – Boschung U. – Pross W. (eds.), *Albrecht von Haller. Leben. Werk. Epoche* (Göttingen: 2008) 485–496, esp. 485; Engl. tr. F.W.S.

from general social and cultural history have only been reluctantly touched upon in this context.<sup>38</sup> This Weimar theologian and philosopher still presents many puzzles to today's scholars; in particular, the means by which he dealt with questions of health, disease and dying. As the latter part of this article will argue, there is an intriguing perspective to be gained from developing a pathographic understanding of Herder's life. This perspective does not only illuminate some paths of thought and his theological leanings, but sheds further light on how he integrated contemporary medical advances into the philosophical accounts in which he popularised such advances. The next part of my essay, on Herder's disease, explores this perspective further by looking at the biographical landmarks in his life, while trying to suggest how his suffering influenced his understanding of human physiology and illness.

*Herder's disease: 'Dacrocystitis congenita'*<sup>39</sup>

Born with a functionally constricted tear duct of the right eye, from early childhood onwards, Herder suffered immensely from recurrent and chronic infections of this eye and the adjacent parts of his face. Quite strikingly, as his early biographer, the idealist philosopher Rudolph Haym (1821–1901), has pointed out, most of the portrait depictions show Herder from the left side of his face [Fig. 2].<sup>40</sup>

In 1770, when Herder was twenty-six years old, he screwed up his courage and sought the help of a renowned ophthalmic surgeon; he travelled to the Alsatian capital of Strasbourg to consult with the local professor of surgery, Johann Friedrich Lobstein (1734–1786).<sup>41</sup> Lobstein first tried

<sup>38</sup> An exceptional article is: Wapnewski P., "Herders Leiden", in Dietze W. – Dahnke H.-D. – Goldammer P. – Hahn K.-H. – Otto R. (eds.), *Herder Kolloquium, Referate und Diskussionsbeiträge 1978* (Weimar: 1980) 1001–1016. However, also Wapnewski did not address the interplay between experiences of illness and the specific intellectual development of Herder's thought and belief system.

<sup>39</sup> '*Dacrocystitis congenita*' is characterised through recurrent infections of the nasal tear duct caused by a congenital obliteration of the duct's opening in the lower eyelid. Zink C., "Dacrocystitis congenita", in Zink C. – Engst R. – Kriwet V. – Schäbl H. – Spitzer T. – Weimann A. – Wolters, J.-W. (eds.), *Psyhyrembel klinisches Wörterbuch mit klinischen Syndromen und Nomina Anatomica* (Berlin-New York: 1986<sup>255</sup>) 321. On the development of major surgical treatment options in this condition, see: Werb A., "The History and Development of Lacrimal Surgery in England and Europe", *Advances in Ophthalmic Plastic and Reconstructive Surgery* 5 (1986) 233–240.

<sup>40</sup> Haym, "Herder nach seinem Leben" 108–117.

<sup>41</sup> Wapnewski, "Herders Leiden" 1012–1016.

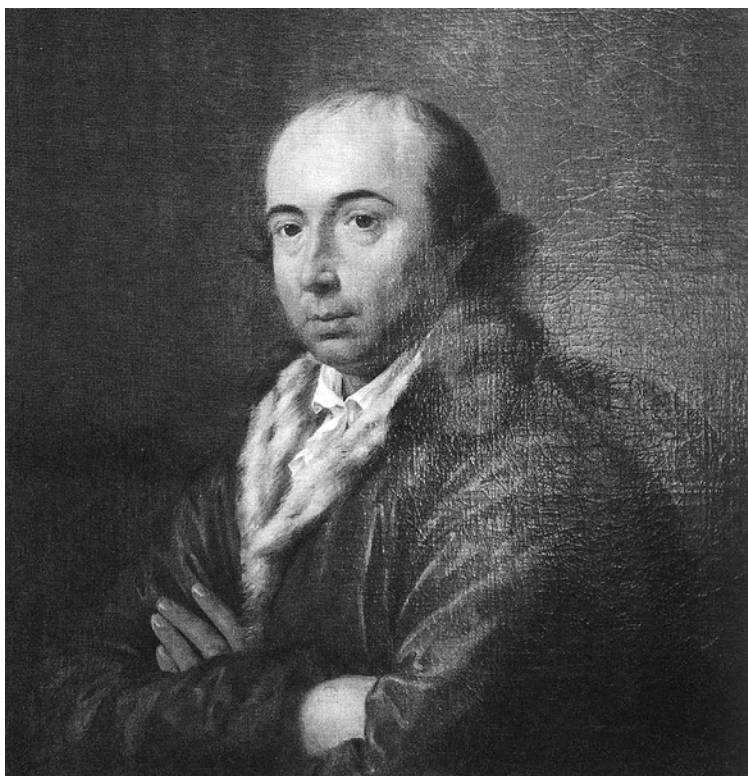


Fig. 2. Friedrich Rehberg, *Johann Gottfried von Herder*, before 1800. Archival records of Johann Gottfried Herder, Goethe and Schiller Archive. Oil portrait on canvas.

blood-letting and, when this was unsuccessful, he then introduced a probe into the tear duct which also was unable to open its lumen.<sup>42</sup> The surgical procedures were performed within the extended period of a three-month stay, during which Herder consulted a number of doctors and received additional physical treatment in the hospital as well as in the baths. This medical journey had been pre-planned and organised by his friend Goethe, who between 1768 and 1771 studied Law at Strasbourg University

<sup>42</sup> For the new therapeutic options available at the time, as well as the restrictions imposed on surgical intervention by the still prevailing humoral physiological model, see Ruisinger M., "Der flüssige Kristall. Anatomische Forschung und therapeutische Praxis bei Lorenz Heister (1683–1758) am Beispiel des Starleidens", in Helm J. – Stukenbrock K. (eds.), *Anatomie. Sektionen einer medizinischen Wissenschaft im 18. Jahrhundert* (Stuttgart: 2003) 101–125, which presents the full array of surgical procedures used by the famous Helmstedt surgeon Lorenz Heister (1683–1758).

and came to appreciate Lobstein's expertise as a surgeon and anatomist while taking medical classes during his first winter semester there.<sup>43</sup> Lobstein then ventured to operate on Herder's obliteration of the tear duct, intending to widen the anatomical lumen underneath the tear sac (the communication between the eye and nose). Following this procedure, a highly painful and purulent condition developed, which – read in terms of modern understandings of infection – developed into a clear *dacrocystitis* of the annexes to the right eye.<sup>44</sup> Goethe described the whole surgical procedure, the punctuation of the ensuing fistula and cauterisation of the infected red part of Herder's eye in his 1811 novel 'Out of my Life. Poetry and Truth' (*Aus meinem Leben. Dichtung und Wahrheit*),<sup>45</sup> while using Herder's own description:

A little channel was drilled into the [Herder's] constantly blocked nose, but the tears did not want to flow through the carefully crafted duct [...]. I was told that my tear sac did not have a normal anatomical position. The sac was pressed in a different direction, too hard, or even too much of a sac, or what do I know? In short, now I have to sit still – under the hands of this otherwise highly able surgeon – full of pain and impatience. I can only trust and hope that the flexibility of my tear sac will later help me to cope with the weather conditions and my eternal cold, which have both conspired against me.<sup>46</sup>

Dr. Lobstein even ventured to use a newly invented technique: he sought to widen the tear sac by pressing little wax sponges and gentian roots

<sup>43</sup> Minor J.M. Le, "The chair of anatomy in the Faculty of Medicine at Strasbourg: 350th anniversary of its foundation", *Surgical and Radiological Anatomy* 24 (2002) 1–5.

<sup>44</sup> Effective treatment of medical problems concerning the lacrimal glands and tear ducts had to wait until more specific operations on the lacrimal glands became possible through inventions such as the lacrimal probe of William Bowman (1816–1892) and the canaliculus knife of Adolph Weber (1829–1915) around 1860. In fact, it would not be incorrect to say that modern dacryology and lacrimal surgery started only in the latter half of the nineteenth century. See also: Werb, "The History and Development of Lacrimal Surgery" 233–240.

<sup>45</sup> Cf. Goethe J.W. von, *Aus meinem Leben. Dichtung und Wahrheit. Zweite Abtheilung*, Book 10 (Tübingen: 1816).

<sup>46</sup> 'Man bohrte in die stets verstopfte Nase [Herders] einen Kanal, freilich wollten die Thränen in den so geschickt gegrabnen Kanal nicht abfließen [...], da mein Thränensack anders liege, oder anders gedrückt sey, oder zu hart und zu sehr Sack sei, oder, was weiss ich mehr? Kurz da muss ich unter den Händen meines sonst sehr geschickten Operateurs noch dasitzen voll Schmerz und Ungeduld und auf die Flexibilität meines Thränensacks, mit dem Wetter und ewiger Schnuppe gegen mich im Bunde sind, hoffen'. From Herder's letter to Caroline Flachsland (1750–1809) in Darmstadt, on November 6, 1770, in Schauer H. (ed.), *Herders Briefwechsel mit Caroline Flachsland. Nach den Handschriften des Goethe- und Schillerarchivs*, vol. 39 (Weimar: 1928) 442f., Engl. tr. F.W.S.



into the opening while he continued his soundings. But this manoeuvre, likewise, failed to deliver the anticipated result. The wound continued to bleed and the tear sac was increasingly filled with a purulent substance so that the duct once again became obstructed.<sup>47</sup> For Herder, the philosopher-patient, this cure eventually ended in a complete disaster – in ‘drooping’ and ‘annoyance’. As a sign of his own distress and also as a souvenir of the suffering he had endured, Herder kept the surgical lead rod with which his wound had so often been poked, for the rest of his life. Following the disappointing outcome to his treatment, he left Strasbourg in February 1771 and returned to Bückeburg, near Hannover, where he held the position of chaplain to the court of Schaumburg-Lippe. Herder’s dreadful experiences are well reflected in a letter of March 1771 to the merchant’s wife, Amalia Rheinholdina Busch (1733–1792), in whose house in Riga he had formerly educated the family’s four children while continuing his theology studies and serving as the cathedral cantor:

Three weeks have turned into twice three months. One surgical incision and one act of nose drilling developed into twenty surgical operations and two hundred soundings of my tear duct. The result: My eye appears worse than it had ever been; after all the pain, the costs, the disturbances, and the annoyances, etc.! I now have enough material to write a tragically amusing story [*epopee*] or a piece of ophthalmomachism [an *ophthalmomachia*].<sup>48</sup>

The continuation of this diseased condition of his right eye resulted in great psychic distress for Herder throughout his whole life. Therefore, is it surprising that even close friends, such as Goethe, perceived him as ‘suspicious’, ‘oversensitive’, often with ‘brusque reactions’, ‘anxious’ and with a ‘depressing’ effect on others? In fact, Goethe himself states that Herder exerted a quasi-magical influence on him, but he did not want to let himself be disturbed by Herder’s continuous lamentations and sometimes outright hostile attitude, regarding it as explicable in terms of what he had

<sup>47</sup> Today, conditions similar to Herder’s are treated through application of antibiotics and additional surgical reconstruction of an artificial tear duct or by *canaliculorhinostomia* – the insertion of a plastic tube into the mucosa of the internal nose: Patel B., “Management of Acquired Nasolacrimal Duct Obstruction: External and Endonasal Dacryocystorhinostomy: Is there a Third Way?”, *British Journal of Ophthalmology* 93 (2009) 1438–1443.

<sup>48</sup> ‘Aus den drey Wochen sind nicht bloß zweimal drei Monathe, sondern aus Einem Schnitt und Einer Nasenbohrung so sind wohl 20. Schnitte u. 200. Sondirungen etc. geworden, u. endlich nach allen Schmerzen, Kosten, Unruhen, Verdrüsslichkeiten etc. ist mein Auge ärger, als es war! Dass ich Materie genug hätte, eine höchst tragischlustige Epopee oder Ophthalmomachie zu schreiben!’. From Herder’s letter to Amalia Rheinholdina Busch in Riga, on March-28, 1771, in Hahn K.-H. (ed.), *Briefe. Gesamtausgabe, 1763–1803* (Weimar: 1984), vol. 1, 323; Engl. tr. F.W.S.



undergone,<sup>49</sup> 'as his [Herder's] illness increased, so did his tendency to disagree vehemently, overshadowing and weakening his invaluable liveliness and amiability. One could not approach him without strongly appreciating his mild character, but also one did not come back from him without being greatly aggrieved [...].'<sup>50</sup> Not only his good friend Goethe and his wife Caroline, but also other close friends, perceived that Herder's health was changed and influenced over long periods of depressive moods. This can certainly be traced back to the enduring pain suffered as a result of the congenital eye condition and his dreadful experiences with surgeons and other physicians. It is striking to see that Herder himself mentioned that he was suffering from a 'hidden disease of the gall bladder', which – as a symptom taken from humoral pathology – fits well with his general constitution, and he often saw new occurrences as a 'relapse of his illness'.<sup>51</sup>

As a consequence of his chronic eye disease and vulnerable constitution, beginning in the 1770s and continuing throughout his whole life, Herder was a frequent visitor to the spas of Bad Pyrmont (Lower Saxony), Carlsbad (Bohemia) and Aachen (in the Rhineland).<sup>52</sup> It seemed that the tranquillity of the spa hotels and the seclusion of these healing places helped him to regain his mental equilibrium and recover from the exertion of his office as Superintendent General. Like his friend Goethe, Herder was a fervent supporter of therapeutic water cures, an appreciation that further developed through his personal acquaintance with the great physician Christoph Wilhelm Hufeland of Weimar. They both met in the duke's residency of Thuringia and later, in 1787, as their pastor Herder even presided over the marriage between Christoph Wilhelm and Juliane Amelung (1771–1845). Young Hufeland, with his magnum opus of 1797, 'Macrobiotics. The Art of Prolonging Human Life' (*Makrobiotik. Die Kunst, das menschliche Leben zu verlängern*), soon developed into one of the most influential physicians and medical theorists of this time.<sup>53</sup> Moreover, he made great progress in promoting the healing effect of bathing, the

<sup>49</sup> Goethe J.W. von, quoted in Wapnewski, "Herders Leiden" 1016.

<sup>50</sup> Goethe J.W. von, quoted in Kohlhausen N. – Sunnus S., *Eine Liebe in Weimar. Caroline Flachsland und Johann Gottfried Herder* (Stuttgart: 1994<sup>2</sup>) 209.

<sup>51</sup> Herder in his letter to Busch, in Hahn "Briefe: Gesamtausgabe" 67; Engl. tr. F.W.S.

<sup>52</sup> Zunckel J.G., "Gedächtnisrede am Grabe Sr. Hochwürd. Magnificenz des Herrn Präsidenten von Herder gesprochen am 21sten Dezember 1803", in Schmidt, "Herder im geistlichen Amt" 280.

<sup>53</sup> Genschorek W., *Christoph Wilhelm Hufeland. Der Arzt, der das Leben verlängern half* (Leipzig: 1986<sup>6</sup>) 38–76.

vitalising and positively 'irritating' effect of cold water applications, and he underlined the general 'activation' of natural healing powers through hydrotherapy.<sup>54</sup>

As already indicated above, there are numerous suggestions that Herder's mood changes and sufferings were not really of an acute nature, or were just reactions to a somatic illness. Concentrating on an earlier letter from 1777 to his editor friend Johann Friedrich Hartknoch (1740–1789) in Königsberg, a chronic ailment seemed to have affected Herder,<sup>55</sup> exemplified by numerous 'symptoms of the mind'. This included, among other things, his prolonged dissatisfaction with his elections into public positions, his continuous personal bitterness over money troubles and his tendency to seek refuge in the private context of his family. The noticeable signs and symptoms displayed by Herder appear to represent an overarching psychosomatic disorder, apparently caused from ongoing depressive resentment.<sup>56</sup> Due to feeling deep-seated disappointment that he could never be relieved of his early childhood disease, Herder often experienced bouts of extreme bad temper that eventually, over time, diminished – in later years only disturbed as a result of an ailment of the right hypochondriac region and individual episodes of 'gall fever'.<sup>57</sup>

*Herder's interest in medicine and his reflections on the natural history  
and physiology of his time*

According to many Herder scholars, his academic interest in medicine and preoccupation with themes from natural history and physiology started with his initial university studies at the Königsberg Medical School.<sup>58</sup> In

<sup>54</sup> Wittern R., "Natur kontra Naturwissenschaft: Zur Auseinandersetzung zwischen Naturheilkunde und Schulmedizin im späten 19. Jahrhundert", *Erlanger Universitätsreden* 37 (1992) 7.

<sup>55</sup> Kohlhausen – Sunnus, "Eine Liebe in Weimar" 214, Biedrzyński E., *Goethes Weimar. Das Lexikon der Personen und Schauplätze* (Zürich: 1992) 199f.

<sup>56</sup> Similar perspectives are still taken in recent research programs on tears and crying as psychosomatic processes; see, for example: Vingerhoets A.J.J.M. – Bylsma L.M. – Rotenberg J., "Crying: A Biopsychosocial Phenomenon", in Fögen T. (ed.), *Tears in the Graeco-Roman World* (Berlin: 2009) 439–475.

<sup>57</sup> Falk J., "Nachrufe", *Zeitung für die elegante Welt* (December 19th, 1803) 1241 and (January 3rd, 1804) 3.

<sup>58</sup> See, for example, Häfner R., "‘L'âme est une neurologie en miniature’: Herder und die Neuropsychologie Charles Bonnets", in Schings H.-J. (ed.), *Der ganze Mensch. Anthropologie und Literatur im 18. Jahrhundert. DFG-Symposium 1992* (Stuttgart: 1994) 391–409, esp. 391–396,

1762, Herder had followed the Prussian regiment surgeon Johann Christian Schwartz-Erla (ca. 1710–ca. 1769) from his home province of Livonia to the East Prussian capital, where the latter practised for many years and where he had held close ties to the Medical Faculty. Not only did Schwartz-Erla try to find effective treatment for young Herder's eye condition as well as offering him the opportunity to study medicine, he also asked him, in return, to translate his own surgical work into Latin. This was his first contact with medical writing.<sup>59</sup>

Herder had already written back to his parents as well as to his former elementary school teacher Sebastian Friedrich Trescho (1733–1804) in Mohrunen, saying that he was quite overwhelmed by the demands of his changed life in Königsberg and the new burden brought by his university studies. As we have seen, he therefore did not continue his medical classes after the first year, instead changing to theology and philosophy. Like his teacher Kant, he continued to be interested in natural history and in the fascinating progress being made in medicine, physiology and surgery in the early Enlightenment; this is reflected in his early study compilations, the *Blue Book* (ca. 1762–1766) from Königsberg and also his later *Brown Book* (1765).<sup>60</sup> Both include many excerpts from Kant's lectures as well as Herder's additional readings in natural history and physiology; for example, the French naturalist George-Louis Leclerc de Buffon's (1707–1788) *Histoire Naturelle* of 1769, from which Herder quoted that 'man, in general, is not sufficiently aware about the interior of his own body'.<sup>61</sup> While this could have been a direct reflection upon his own ailment, it was also an expression of Herder's curiosity as to what the sciences of his day could contribute to philosophical and anthropological thought more generally.

In the *Blue Book*, for example, Herder referred back to the *Elementa physiologiae* of the Swiss-German physician and polymath Albrecht von Haller and drew attention to the latter's theory of 'irritability' (*Irritabilität* or *Erregbarkeit*) and 'sensibility' (*Sensibilität* or *Empfindlichkeit*) as major

---

Stiftung Weimarer Klassik (ed.), *Johann Gottfried Herder. Briefe*, eds. Dobbek W. – Arnold G. (Weimar: 1996), vol. 10, 250–253.

<sup>59</sup> Haym, "Herder nach seinem Leben" 20f.

<sup>60</sup> Herder's so-called 'Brown Book', bound in a brown cover, is a compilation of handwritten notes, on theological and philosophical matters in particular, and includes a number of considerations on natural history. Herder completed the 'Brown Book' later in Riga in East Prussia (today Latvia) (in: Capsule XXI; AHN, of the Manuscript and Incunabula Collection of the Berlin State Library; Culture Forum).

<sup>61</sup> See in Capsule XXIX; AHN; 1, C; 1 f/b.

physiological concepts to explain the functioning of the living body.<sup>62</sup> Von Haller, recognised by eighteenth-century scholarship as one of the major theorists of the fibre doctrine of nerve action, also introduced a new concept; that the structural properties of the nerves consisted in their 'sensitivity' to external stimuli (such as in the cranial nerves leading to annexes of the eyes) and, of the muscles, that their 'contractility' (as in the small muscles of the tear glands) lay in the ability to act and move both voluntarily and involuntarily. Moreover, from 1757, Haller also emphasised that any nervous fluid, remaining after it had effectively instigated movements in the body, could be reabsorbed from the organs' periphery and the inner cavities, while it was being transported back to the brain directly through the fine nerve channels. Although structurally resembling the circulation system with flow outwards through the arteries and back through the veins, it would form a circulatory system of its own, with the tear gland apparatus acting as one of its pressure valves.<sup>63</sup> In addition, Haller points out that the notions of 'irritability' and 'life force' had already acquired great popularity in the enlightened circles of the period. Starting with his famous experiments on irritability, using frogs as test animals, he claimed to have identified the fundamental difference between the physiological dispositions of individual body parts, for example the disposition of a muscle to be irritable, and that of nerves to be sensible,<sup>64</sup> a finding which changed the views of those scholars of physiology who came after him. For Herder, in particular, Haller's demonstration of the substrate and function of the tear glands proved to be highly stimulating for his own reflections on the physiology and mechanism of tears and crying:

Still another cause [of crying] is the instance of a gentle passion, whether it is united with great joy or deep grief. In the instance of joy, the tears start to flow because of the great luck of a friend or during the meditation of an example of great virtue [*ein bewundernswürdiges Beispiel einer Tugend*]. If these instances are presented to highly sensitive persons, they will immediately burst into tears. And that this also brings about deep sad-

<sup>62</sup> Haller, "Anfangsgründe der Physiologie", vol. I, 314.

<sup>63</sup> With the introduction of the concepts of 'sensitivity' and 'irritability', Haller provided a new physiological basis for the understanding of the vital function of the living bodies, a development, which provided a decisive departure to the physicalist and mechanist tradition that had followed to René Descartes (1596–1650) also in medicine and biology. For a more, in depth discussion, see: Steinke H., *Irritating Experiments. Haller's Concept and the European Controversy on Irritability and Sensibility, 1750–1790* (Union, NJ-Amsterdam: 2005) 93–126.

<sup>64</sup> Töllner R., *Albrecht von Haller. Über die Einheit im Denken des letzten Universalgelehrten* (Wiesbaden: 1971) 173–182.

ness is likewise known to everyone [*Und dass dieses die Traurigkeit bewirke, ist Jedermann bekannt*].<sup>65</sup>

As is reflected in Herder's famous *Blue Book*, he not only followed the course of Kant's exposé of contemporary mathematical and physical sciences but also brought in other concepts of leading physiologists – especially Haller's *Elementa physiologiae* – concerning the functioning of the body, alongside his own considerations of the *meaning* of 'tears' for the human condition [Fig. 3].

It is precisely here – even though scholars like Richard Töllner have also underlined the physico-theological views of the Bern physiologist<sup>66</sup> – that the theologian-philosopher goes well beyond Haller's substrate-oriented physiology. Herder now asks a proto-psychosomatic question, as in his 1800 essay 'On the Meaning of Emotion' ('*Zum Sinn des Gefühls*');<sup>67</sup> namely, what were the physiological *and* psychological or anthropological functions of tears and crying: were they an expression of the soul and a direct effect of this non-physical entity? Would the soul reside in the fibres of the body and was it also subject to physical sensibility?

These reflections were not of purely theoretical interest for Herder; they also had considerable practical value and implications. For example, he further speculated about the coming of a new medical profession, that of a 'physiologist of both the soul and the human body' ('*Ein Physiologe der Seele und des Körpers des Menschen*')<sup>68</sup> which '[...] we do not yet have. He [the physiologist of the soul and body] will then fully tell us what it is to think and to hear! In all these three notions [in the preceding chapters Herder discussed 'thought', 'body', and 'sensibility'], we get the whole metaphysics of space, time and force'.<sup>69</sup> Herder was quite explicit about how such a future psychophysiology could work in practical terms. He developed this theme in his 1774 psychophysiological essay

<sup>65</sup> 'Noch eine andere Ursache [Weinen] beruhet auf eine zarte Leidenschaft, es mag sich nun selbige mit der Freude, oder mit der Betrübniß vereinigen. So fließen bei der Freude über das grosse Glück eines Freundes, oder über ein bewundernswürdiges Beispiel einer Tugend, so man lebhaft schildert, Personen von empfindlichen Sinnen, die Thränen häufig in die Augen. Und dass dieses die Traurigkeit bewirke, ist Jedermann bekannt'. Haller, "Anfangsgründe der Physiologie", vol. V, 741f., Engl. tr. F.W.S., and also Herder, *Blue Book* 30f.

<sup>66</sup> Töllner, "Fragmente Religiöser Empfindung" 490.

<sup>67</sup> Herder, J.G. von, *Zum Sinn des Gefühls* (1800), in Pross, *Herder. Werke*, vol. II, 241–250.

<sup>68</sup> Herder, J.G. von, *Zum Sinn des Gefühls* (1800), in Pross, *Herder. Werke*, vol. II, 244.

<sup>69</sup> Herder, J.G. von, *Zum Sinn des Gefühls* (1800), in Pross, *Herder. Werke*, vol. II. Engl. tr. F.W.S.





'On Perception and Emotion' ('*Vom Erkennen und Empfinden*'),<sup>70</sup> where he specifically receives, and uses, the Hallerian physiological doctrine of 'irritability', squaring this with the traditional notion of a healthy bodily equilibrium in order to produce a detailed explanation of how the flowing of tears occurs, and what this process means in terms of the wider psychological context addressed:

Nature works in manifold ways, right up to the infinite. She changes herself in all grades possible, so that her general actions cannot be applied in the full and necessary depth to all parts of the body [...]. We realise that when one part of the body is mutilated, its fluids are attracted towards the neighbouring, homogenous part, and they strengthen it considerably. That is also the case with the genius [*dem Genie*] of sensibility and the internal drives. Those organs, which nature neglects, wither, whereas all others will continue to thrive.<sup>71</sup>

According to Herder's physiological views, *tears* are interpreted as an element of physical compensation of bodily fluids or the effect of scarcity or overflow in other organs. This assumption derives from, and further expands, Haller's 'overflow model of crying', in which the tear glands are affected by the irritability of the fibres that loosen the (muscular) valves of the lachrymal glands so that the tears can freely run from the eyes:

Regarding the nature of this liquid [the tears], we only know a few things, namely that it is clear and salty water, which completely evaporates when it is brought into contact with fire. I [Haller] am not aware of a chemical analysis of the tears, as it is barely possible to collect enough fluid from the lachrymal glands to pursue such kinds of experiments. I have read, however, that they can build crystals. It happens quite often that small stones are formed in the tear ducts as in all the other aqueous liquids of the human body.<sup>72</sup>

<sup>70</sup> Herder, Johann Gottfried von, *Vom Erkennen und Empfinden* (1774), in Pross, *Herder. Werke*, vol. II, 543–579.

<sup>71</sup> 'Die Natur arbeitet ins Mannichfalte, ins Unendliche; sie verändert mit allen Graden, und kann also selten diese Tiefe über alle Organe erstrecken [...]. Wir sehn, wenn ein Glied des Körpers verstümmelt wird, dass sich die Säfte wohl nach dem andern, nachbarlichen, ihm homogenen hinziehen und es ungewöhnlich verstärken; so gehts mit diesem Genie an Empfindungen und Trieben. Die von der Natur versäumten, und im Verfolg ungebrauchten Organe dorren, andre nehmen zu sehr überhand'. 572f.; Engl. tr. F.W.S.

<sup>72</sup> 'Wir wissen von der Natur dieser Feuchtigkeit [der Tränen] nur was wenig, nämlich, dass sie ein helles, doch salziges Wässerchen ist, welches im Feuer ganz und gar verbräucht. Ich [Haller] kenne keine chemische Auseinandersezung der Thränen, da man schwerlich sehr viel davon sammeln kann, als zu einem Versuche hinlänglich ist. Ich lese, dass sie zu Kristallen angeschossen: und es geschieht nicht selten, dass sich wie in den übrigen wässrigen Feuchtigkeiten des menschlichen Körpers, so auch ebenfalls in den



For Haller, the tears thus displayed an important property in that they could form a solid substance of the body, and could serve as primary elements to build up the individual fibres of the living body. This assumption of a primordial character of tears, not only as excess body fluid but also as physiological building blocks was, of course, still a continuation from the tradition of humoral pathological views.<sup>73</sup> Herder discussed humoral views not only in his physiological reflections, but also in the letters to his wife Caroline, where the extensive influence of the liver and the gall bladder is emphasised. These signs can be seen as indicators for Herder's general constitution, a situation which may be referred back to the contemporary medical theories of the day in which reinterpretations of ancient humoral pathology were part of medical education right into the mid-nineteenth century. Nevertheless, with the advent and progress of organ pathology, a change in medical theory had occurred in that individual humoral conditions were now more strongly related to specific bodily organs.<sup>74</sup> It is not astonishing, then, to see Herder's illness described as often being 'depressed' and at the same time as being 'short-tempered', suffering from 'hardening of the liver' and found to be 'suffering from a gall fever' or from 'gall cramps' – in a sense being typical patterns of a 'melancholic', sometimes 'choleric' picture from humoral pathology.

What was decisive for Herder himself was the assumption of the fundamental physiological character of the bodily fluid of tears, which gave him *carte blanche* to claim that they acted as mediators between, firstly, the physiological function and morphological structure of the body. Secondly, in accordance with Haller, their assumed primordial nature as 'building blocks' of the body allowed Herder to introduce his conception of tears as a *tertium comparationis* of the *Elementa physiologiae*, that is, as the missing link between bodily physiology on the one hand and human emotion

---

Thränen, Steine erzeugen'. Haller, "Anfangsgründe der Phisiologie", vol. V, 739f.; Engl. tr. F.W.S.

<sup>73</sup> Following Galen's comments on the Hippocratic *De natura hominis*, physicians understood that the four humours (blood, phlegm, black, and yellow bile) made up the essence of the body and that health depended on their balance. Pain is felt when one of these humours is lacking or in excess in the body, without being compounded with the other humours. When more of any one specific humour left the body, then the mere process of this flow caused suffering. *Tears*, according to this model, were associated with melancholy and as such with the abundance of black bile. See, for example, Grant M. (ed.), *Galen on Food and Diet* (London-New York: 2000) 30f., Fögen, "Tears and Crying in Graeco-Roman Antiquity" 4f.

<sup>74</sup> Cf. Hess V., *Von der semiotischen zur diagnostischen Medizin. Die Entstehung der klinischen Methode zwischen 1750 und 1850* (Husum: 1993) 31–33.

on the other:<sup>75</sup> Beyond the rather mechanistic interpretations of the *anatomia animata*<sup>76</sup> of the human body, as in Haller's doctrine, Herder stressed the psychophysiological dimension of tears as the paradigmatic example for the workings of the soul in full concert with the physiological actions in the human body (while relating to emotional states of joy, fear, sorrow, and anger, and so on). Not only does the soul act, according to Herder, when perceiving a sad or joyful situation, but it continues its influences along a complete spectrum from 'sensibility' to 'irritability' – especially conceiving and comparing emotions and bodily actions with or without the influence of volition and human intentionality.

When creating his own idiosyncratic physiological theory, Herder widely exploited the perspective of tears as mediators between physiology, psychology and, for him, more often spirituality. In fact, he developed it into a model which was based on a number of anthropological background assumptions,<sup>77</sup> which sought to explain why certain people are more prone than others to tears and crying. In the contemporary context of 'Sensitivity' (*Empfindsamkeit*) this had become a decisive question in determining devoutness, moral virtues, even the essence of humanity at large. For Herder, people who cry and show their tears present a stronger degree of receptivity to sensitive events. This condition further explained

---

<sup>75</sup> In his primary discussion of the *tertium comparationis*, particularly in focusing on the aesthetics of the sense impressions and the semiology of their meanings, Herder emphasised that there must be an overlapping quality, which two things need to have in common and without which no comparison would be possible. In particular, Herder criticises Gottfried Ephraim Lessing (1729–1781) for having conflated the signs of poetry with the signs of painting in the latter's work of 1766 *Laocoon. An Essay on the Limits of Painting and Poetry* (*Laokoon oder Über die Grenzen der Mahlerey und Poesie*), in which Lessing reflected on an adequate representation of pain and suffering through aesthetic means. It is particularly in his attack on Lessing that Herder uses physiological background assumptions. For example, he states that the physical materiality of bodies yields a point of comparison between the sublime and physiological functions. Later in his argument, Herder accuses Lessing of having mixed up the two aesthetic perspectives of painting and poetry, because 'The signs of painting are natural. The relation of the sign to what is ostentatiously referred to is grounded in the thing itself'. The signs of poetry, however, are absolutely arbitrary, according to Herder. The articulated sounds have nothing in common with the thing that they represent. They are only accepted on the grounds of a mutually shared convention, so that the nature of both is unequal and the *tertium comparationis* vanishes. Herder, Johann Gottfried von, "Kritische Wälder. Oder Betrachtungen, die Wissenschaft und Kunst des Schönen betreffend. Erstes Wäldchen XI. Herrn Lessings Laokoon gewidmet (1769)", in Suphan B. (ed.), *Herder – Sämtliche Werke* (Berlin: 1883), vol. 3, 239.

<sup>76</sup> On the concept of the vital elements of morphological structures, as represented in the figure of the *anatomia animata*, see Töllner, "Albrecht von Haller", 137–140.

<sup>77</sup> I have described this perspective elsewhere as Herder's 'anthropological physiology'; see Stahnisch, "Herder's 'Anthropologische Physiologie'" 826f.

to him why pious prayer or the singing of a church song could give rise to tears through an act of immersing oneself in eternal joy and deepest grief – a perspective that the theologian in Herder was certainly most interested in investigating. It is no coincidence, then, that both Herder and Haller deemed tears physiologically basic to the irritability of specific anatomical structures (the tear glands, the eyelids, or the adjacent facial musculature etc.) such as Haller had described in his chapter on physiology ‘On the Nature of the Tears’ (*‘Über die Natur der Tränen’*)<sup>78</sup> of his basic textbook – the *Elementa physiologiae*. However, Herder’s theological understanding and sentimentalist ethics came to be much more strongly related to the knowledge about the inner self and human emotions. Like other theorists of ‘sensitivity’, he regarded a deep knowledge of the personal ‘heart’ and ‘feelings’ as providing the primary access to the highest degrees of virtue and coercion with other human beings. Although tears and crying were certainly important aspects of the individual being, his or her emotional state was seen as a crucial determinant of human communication in broad terms.

For Herder, tears could only be fully comprehended when they were appreciated as a means to further understanding between individuals, that is, as an expression of empathy (as: *Mitfühlen*) and a true sign of offering help and support. Sensitivity, in general, was the particular means by which social virtues were supported and achieved and, in return, spiritual development could likewise only be attained through introspection and emotional experience. He thus understood the gentler emotions such as love, tenderness, friendship, empathy and melancholy as particularly valued for their social character, a dimension that is largely absent from his physiologist contemporary, Haller.<sup>79</sup>

*The philosopher-theologian as medical patient: A creative tension*

Herder deliberately introduced his own experiences as a patient into many of his academic writings, poems, and religious sermons, providing subjective, if not objective instances of comparison with the state of contemporary physiological knowledge.<sup>80</sup> When looking at Herder’s unpub-

<sup>78</sup> Haller, “Anfangsgründe der Physiologie”, vol. V, 741f.

<sup>79</sup> Cf. Elferen I. van, “‘Ihr Augen weint!’ Intersubjective Tears in the Sentimental Concert Hall”, *Understanding Bach* 2 (2007) 77–94, esp. 78f.

<sup>80</sup> See also Wapnewski, “Herders Leiden” 1013–1016.

lished notes, philosophical publications and essays on contemporary medical theory, it becomes clear that his views on the physiology of tears were located at the cross-roads between intellectual and theological interest, and personal suffering; also, that these views came out of numerous encounters with contemporary physicians and natural historians.<sup>81</sup>

During his studies at Königsberg, it already appeared to Herder that the acquisition of specific knowledge about the human physiological condition could not be a question of mere reasoning and animal experimentation alone,<sup>82</sup> but ought to involve psychological assumptions as well. When he changed to become a student of theology, these considerations were increasingly embraced, in religious terms, and spelled out as examples of a wider communication with God, expressed, for example, in Herder's poem 'See the celestial physician with a quiet gaze' ('Schaute den himmlischen Arzt mit stillem Blicke'), written in his student days:

See the celestial physician with a quiet gaze | the soul that passed away |  
[open the doors for the Supreme]. The mother cries, oh! what moist tears |  
[God displays wonders of his gentle deeds]; and [is] full of power and force.  
| See, he [can] raise you to eternal [life].<sup>83</sup>

Even though the interpretation of God as having the highest capacity for healing both the body and the soul was widely present in theological views about health and illness – developed to a very high degree in contemporary views<sup>84</sup> – it is Herder's juxtaposition of the poem with excerpts from natural history and medical treatises which represents the particular physico-theological perspective. While the mention of the 'mother's moist tears' can be seen as in complete harmony with the figuring of literary and theological sensitivity in the general context of *Empfindsamkeit*, the eschatological perspective 'on the wonders of [God's] gentle deeds' and the recurrent image of 'man as a mirror of God' were directed towards the

<sup>81</sup> Cf. Stahnisch, "Herder und die Neurowissenschaften" 129f.

<sup>82</sup> For the individual physiological practices of eighteenth-century physiology, see: Steinke, "Irritating Experiments" 49–92.

<sup>83</sup> 'Schaute den himmlischen Arzt mit stillem Blicke | die verstorbene Seele | [öffnet die Türen dem Erhabenen]. Es weint die Mutter, o wie feuchte Tränen | [Er gibt Wunder seines zärtlichen Tuns]; nur da Kraft in seiner Stärke [ist]. | Seht, er [kann] in Zukunft [zum Leben] wecken | [Dich auch]'. Herder, "Schaute den himmlischen Arzt mit stillem Blicke", unpub., n.d. (ca. 1762/1763) (Capsule XX; AHN (*Abteilung für Autographen, Handschriften und Nachlässe*); of the Manuscript and Incunabula Collection of the Berlin State Library; Culture Forum).

<sup>84</sup> See, for example, in: Viehmeyer L.A., "Abraham Wagner and George de Benneville: Physicians of Body and Soul", in Helm J. – Wilson R. (eds.), *Medical Theory and Therapeutic Practice in the Eighteenth Century. A Transatlantic Perspective* (Stuttgart: 2008) 261–280.

general possibility of a physiologically and psychologically healthy being. Following Herder, complete rejuvenation of the body parts and fluids – and likewise psychophysical healing – was only possible through the powers of ‘the celestial physician’,<sup>85</sup> which he further translated into a form of procedural ethics, namely the rapprochement with the sick and suffering person – the *homo patiens*.<sup>86</sup> This literary figure likewise bears strong idiosyncratic similarities with the chronically-ill Herder, who had to cope with recurrent infections of his eye and for whom the subject of ‘tears’ was more than just a theoretical issue during the Age of Sensitivity. Even more so, crying and tears became a constant, even daily, individual health concern for Herder – hence, more than everything else, tears became truly ‘an analogue, mirror and exterior imprint of the actions of the soul’.<sup>87</sup>

Previously, in his 1772 *Essay on the Origins of Language* (*Abhandlung über den Ursprung der Sprache*), awarded the Prize of the Royal Prussian Academy for the Arts and Sciences in Berlin two years previously, Herder did not just reflect on human consciousness and the materiality of the human body, but also transferred such theoretical considerations into a medical account of health and disease. Placing the focus on the physiological functions of bodily organs and the phenomenological unity of the human individual, Herder based his theory on the current anthropological assumption of the ‘double nature of man’, which would later form the background to his wider psychological and medical considerations.<sup>88</sup> His notions were always oriented towards a holistic gaze, which he also expected of the medical doctors of his time. In a way, this also tied in with the programme of a new group of younger physicians, working around 1800, who stressed the need to observe a much tighter pathogenetic relationship between the physical and the mental health constitution of each individual patient. Hufeland can be seen as one of the major protagonists of this trend; in his magnum opus, *Macrobiotics. The Art of Prolonging Human Life*, he emphasised that a stricter observation of the physiological and psychological equilibrium was essential for preserving a healthy body in general:

<sup>85</sup> Herder, “Schaute den himmlischen Arzt” n.pag.

<sup>86</sup> Stolberg M., *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (Cologne: 2003).

<sup>87</sup> Herder, “Vom Erkennen und Empfinden” 548.

<sup>88</sup> See also: Ruprecht E., “Herders Gedanken Über die Seele und ihre Unsterblichkeit”, in Poschmann B. (ed.), *Bückeburger Gespräche über Johann Gottfried Herder 1779* (Bückeburg: 1980) 31–49.

Who can write about human life without considering the moral world, to which each individual also belongs? [...] numerous instances clearly show that the human being has been designed for a higher moral destiny. And this makes for a most decisive difference between the nature of man and that of an animal. Without any human culture in general and without the culture of an individual person, man will constantly be in opposition with his nature; and he will only develop into the most perfect human being, if he observes [this double nature].<sup>89</sup>

Herder further claimed that the phenomenology of the patient's condition was tightly linked to the general context of language regarding both the expression and the healing of an illness.<sup>90</sup> This demand possibly originated in Herder's own experiences with the physicians caring for him in Königsberg, Strasbourg and Bückeburg (Westphalia), 'those high priests and nosy scholars, who arrive with their servants carrying swords and needles'. It seems unlikely that his own physicians paid to the psychosomatic condition the amount of respect for which Herder himself had called, in his essay 'On Perception and Emotion in the Human Soul' (*Vom Erkennen und Empfinden der menschlichen Seele*) of 1774:

Psychological Physiology is the most important part of universal wisdom, because this discipline alone can give us access to the (innermost) sanctuary of the soul [...]. Without all mysticism, and in the strictest philosophical sense [*im schärfsten philosophischen Verstande*], the inner man is identical to the outer man, through and through. The latter is only a shell for the former, and *a priori* [*Albrecht von*] Haller, [*Richard*] Mead [1673–1754], [*Johann Georg von*] Zimmermann are certainly his confidants more than all earlier thinkers together; for *a priori* we know nothing about the soul.<sup>91</sup>

<sup>89</sup> Hufeland, Christoph Wilhelm, *Die Kunst, das menschliche Leben zu verlängern* (Jena, Akademische Buchhandlung: 1797) Vorrede, 16 'Wer kann vom menschlichen Leben schreiben, ohne mit der moralischen Welt in Verbindung gesetzt zu werden, der es so eigentümlich zugehört? [...] unwiderlegliche Gründe tun dar, dass schon das Physische im Menschen auf seine höhere moralische Bestimmung berechnet ist, dass dieses einen wesentlichen Unterschied der menschlichen Natur von der tierischen macht, und dass ohne menschliche Kultur der Mensch unaufhörlich mit seiner eigenen Natur im Widerspruch steht, sowie er hingegen durch sie [die Doppelnatur] auch physisch erst der vollkommenste Mensch wird'. Engl. tr. F.W.S.

<sup>90</sup> Herder, "Abhandlung über den Ursprung der Sprache", in Pross, *Herder. Werke* vol. 2, 251–399, esp. 254f.; Engl. tr. F.W.S.

<sup>91</sup> Herder, "Vom Erkennen und Empfinden" 563 '[Die] Psychologische Physiologie [ist] der wichtigste Teil der Weltweisheit. Sie allein kann uns ins Heiligtum der Seele führen: [...] Ohne alle Mystik und im schärfsten Philosophischen Verstande ist der innere Mensch dem äussern durch und durch einwohnend: dieser nur die Hülle von jenem, und die [*Albrecht von*] Haller, [*Richard*] Mead [1673–1754], [*Johann Georg von*] Zimmermann sind mehr, als alle Grübler *a priori*, seine Vertrauten: denn *a priori* wissen wir von der Seele nichts'. Engl. tr. F.W.S.

This discussion of Herder's physiological views would not be complete without emphasising his deep roots in theology and his central belief in the eternal soul. With his metaphysical confession: 'Yes, I find in language and in the essence of God the direct cause, why nobody other than God himself could have created it', Herder – in contrast to Haller<sup>92</sup> – was convinced that the soul resides directly in the body; it could affect human physiology at any moment and was explicitly subject to the worldly influences of God:

So here we have to stick with experience and clear notions, for both of which it is enough to understand why they could not be complete. Here, we find the forces of the soul [*die Kräfte der Seele*] distributed, as it were, uniformly in all of the manifold actions of the vital body. Without particular parts of our body, we feel, no rational thought can even be possible: [...] The soul feels itself to be part of the body, and feels comfortable there [...]. *Mens sana in corpore sano*.<sup>93</sup>

From his perspective in 'On Perception and Emotion in the Human Soul', where he argued for a functional meaning of the unity of body and soul, Herder not only explained how he understood the existence of consciousness itself, but also argued for an inseparable relation between the human body and soul.<sup>94</sup> In light of these theological interpretations, however, the mortal body was no more than a 'sheath of the mind', an idea that he had already expounded in his views on human evolution, and which figures strongly in his best-known book, the *Ideas on the Philosophy of the History of Mankind* of 1784–1791.<sup>95</sup> In Herder's physiological thought, it also comes as no surprise to find the newly-emerging interpretation of living phenomena in an anthropological perspective. If we follow the recent

<sup>92</sup> In modern terms of the philosophy of mind, although the positions of Haller and Herder are not analytically clear cut, it is possible to align Haller's views primarily with dualist theories of the mind-body relation. On the contrary, Herder argues more for an epiphenomenalist theory of mind, based on an inherently universal assumption of the mind-matter relationship. For the modern theories see, for example, Plantinga A., "Evolution, Epiphenomenalism, Reductionism", *Philosophy and Phenomenological Research* 68 (2004) 602–619.

<sup>93</sup> Herder, "Vom Erkennen und Empfinden" 548 'Wir müssen hier also bloss bei der Erfahrung und bei klaren Begriffen bleiben, von denen es genug ist, einzusehen, warum sie nicht vollständig werden konnten. Da finden wir nämlich die Kräfte der Seele gleichsam ausgebreitet in alle manichfaltige [!] Verrichtungen des organischen Leibes. Ohne gewisse Teile, fühlen wir, kann unser Denken nicht vor sich gehen: [...] Die Seele fühlt sich im Körper, und fühlt sich wohl [...]. *Mens sana in corpore sano*'. Engl. tr. F.W.S.

<sup>94</sup> Herder here uses the famous Latin quotation that 'a healthy mind is in a healthy body' from the tenth satire by the Roman poet Juvenal (ca. 55 AD–ca. 135 AD): Juvenalis, *Satyræ* 10.356.

<sup>95</sup> Herder J.G. von, qtd. in Unger R. (ed.), *Gesammelte Studien. Zur Dichtungs- und Geistesgeschichte der Goethezeit* (Darmstadt: 1966), vol. 3, 25.



account of the cultural philosopher, Johannes Bierbrodt, then we must see the whole period as a decisive break with traditional knowledge systems:<sup>96</sup> this break was not found in earlier cosmological and naturalistic accounts. The new way of thinking about the world was expressed in the emphasis on physical anthropology, investigating questions about man's relation to animal physiology, or the general relationship between the mind and the soul. In particular, an important trend in enlightenment and eighteenth-century research was to investigate human behaviour within the constraints of the life world.

Herder's anthropological assumption of the 'double nature of man' – which he conceived as an inseparable physiological and spiritual unity – diverged from the dominant academic discourse, as it continued to be deeply entrenched in Christian theological thought.<sup>97</sup> It also exhibited the need for a substrate of communication between the anatomical fibres of the brain and the nerves, and the 'irritable' and 'sensible' units of the human physiology, such as the lachrymal glands. This substrate was seen here as transcending the realm of living phenomena, explaining human consciousness and the particular possibility of a spiritual communication with God through tears and emotions. For Herder, the physiology of tears was a prime expression of the special unity between sensitivity, emotion and virtue and, as such, they were reliable and trustworthy *a posteriori* signs of the existence and workings of the soul in the human body.

### Conclusion

In this historical *précis*, I have sketched out how Herder's personal interests – strongly shaped through his own biographical background and the condition of his congenital tear duct disease – played right into his pre-occupation with contemporary physiological theory. The new interpretations disseminated by the influential Weimar polymath became related to general physiological theory, as well as to the specific discussion of tears, in that they appeared to him as prime elements which allowed for a discussion both of the workings of the body and of the nature of human emotions. Although he placed a great emphasis on the supremacy and

<sup>96</sup> Bierbrodt J., *Naturwissenschaft und Ästhetik 1750–1810* (Würzburg: 2000) vii.

<sup>97</sup> See also Soboth C., "Tränen des Auges, Tränen des Herzens. Anatomien des Weins in Pietismus, Aufklärung und Empfindsamkeit", in Helm J. – Stukenbrock K. (eds.), *Anatomie. Sektionen einer medizinischen Wissenschaft im 18. Jahrhundert* (Stuttgart: 2003) 293–315.

the observable actions of the soul, Herder certainly also shared, and even relied on, Haller's earlier physiological notion of 'irritability' as the basic property of all living body structures. Nevertheless, he went one step further. Herder integrated the concepts of 'sensibility' and 'irritability' as the substrate of the soul, as central features of his 'anthropological physiology', because 'crying', religious belief and gentle emotions found their expression in a primary physiological faculty. These basic physiological assumptions figured strongly in many of Herder's metaphors, such as the 'delicate, irritable nerves' ('zarte reizbare Nerven') or the 'complete atony of the vital functions' ('völlige Atonie der Lebensfunctionen').<sup>98</sup>

Like Haller, who alluded to scholastic and Renaissance views about tears as being secreted from the fluids of the anterior ventricles of the brain,<sup>99</sup> Herder linked his conception of 'tears' particularly to a discussion of the brain as the pivotal organ of the human body and as a genuine tool of the soul (*Werkzeug der Seele*). For him, this assumption paved the way to consider the idea that tears acted as mediators between the sublime and the actual bodily physiology. However, this step could hardly have been taken without a hidden theological agenda, nor could it have come out of the blue – Herder here was affected by the disease of his own tear duct. His personal views about the physiology of the tears developed from his own observations of the 'psychosomatic' interaction between depressive moods and recurrent instances of crying. To these were added experiences which he had had as a theologian of the 'Age of Sensitivity'.<sup>100</sup> For the philosopher-patient Herder, the physiology of tears became a *tertium comparationis* of the *Elementa physiologiae* as Haller had seen them. Tears appeared at the intersection between fine meditations of the soul, the rough human condition and the worldly materiality of human suffering. It is in this context of the 'double nature of man' that Herder considered *tears* and *crying* as an expression of the residential *internal man* in the *external* and as mediators between the sublime and the bodily physiology.

<sup>98</sup> See also the discussion of Herder's position in contemporary cultural discourse about women's nerves and brains in: Stahnisch F., "Über die neuronale Natur des Weiblichen: Szientismus und Geschlechterdifferenz in der anatomischen Hirnforschung (1760–1850)", in Stahnisch F. – Steger F. (eds.), *Medizin, Geschichte und Geschlecht. Körperhistorische Rekonstruktionen von Identitäten und Differenzen* (Stuttgart: 2005) 197–224, esp. 205f.

<sup>99</sup> Compare, for example, the doctrine on the morphological substrate of the ventricles for the physiology of the senses and emotions in Johann Eichmann (= Dryander; 1500–1560), on which he expounded in Dryander, *Anatomiae hoc est, corporis humani, dissectionis pars prior* (Marburg: 1537), Sig. g., iv.

<sup>100</sup> Cf. Minter, "Literary 'Empfindsamkeit'".

*Selective bibliography*

- ARISTOTLE, *De anima*: ed./tr. Karsch A. (1847), *Über die Seele, III. Schriften zur Naturphilosophie*, 10 vols., Stuttgart.
- BATES D., "Why not call Modern Medicine 'Alternative'?", *Perspectives in Biology and Medicine* 43 (2000) 502–518.
- BONIN D., *Johann Georg Zimmermann u. Johann Gottfried Herder nach bisher ungedruckten Briefen* (s.n.: 1910).
- BIEDRZYNSKI E., *Goethes Weimar. Das Lexikon der Personen und Schauplätze* (Zurich: 1992).
- BIERBRODT J., *Naturwissenschaft und Ästhetik 1750–1810* (Würzburg: 2000).
- BUFFON GEORGE-LOUIS LECLERC DE, *Histoire Naturelle générale et particulière, avec la description du Cabinet du Roy*, 4 vols. (Paris, L'Imprimerie Royale: 1774–1776).
- CANGUILHEM G., *La formation du concept de réflexe aux XVII<sup>e</sup> et XVIII<sup>e</sup> siècles* (Paris: 1955).
- CHARON R., "Bearing Witness: Sontag and the Body", *New England Journal of Medicine* 352 (2005) 756.
- COLEMAN W. – HOLMES F.L. (eds.), *The Investigative Enterprise. Experimental Physiology in Nineteenth-Century Medicine* (Berkeley: 1988).
- CRAIK E., *The Hippocratic Treatise on Glands* (Leiden: 2009).
- DEBRU C. (ed.), *Essays in the History of the Physiological Sciences* (Amsterdam-Atlanta, GA: 1995).
- DOBBEK W. (ed.), *Herders Briefe*, ed. Dobbek W. (Weimar: 1959).
- DRYANDER, *Anatomiae hoc est, corporis humani, dissectionis pars prior* (Marburg, E. Cervicornus: 1537).
- DUCHESNEAU F., *La physiologie des lumières. Empirisme, modèles et théories* (The Hague: 1982).
- DÜNZER H. – HERDER F.G. VON (eds.), *Aus Herders Nachlass, ungedruckte Briefe von Herder und dessen Gattin, Goethe, Schiller, Klopstock, Lenz, Jean Paul, Claudius, Lavater, Jacobi und andern bedeutenden Zeitgenossen*, 2 vols. (Frankfurt: 1856–1857).
- EBERSBACH V., *Carl August. Goethes Herzog und Freund* (Cologne: 1998) 101–103.
- EDELSTEIN L., "The Relation of Ancient Philosophy to Medicine", in Temkin O. – Temkin C.L. (eds.), *Ancient Medicine. Selected Papers of Ludwig Edelstein*, tr. Temkin C.L. (Baltimore: 1967) 349–366.
- ELFEREN I. VAN, "‘Ihr Augen weint!’ Intersubjective Tears in the Sentimental Concert Hall", *Understanding Bach* 2 (2007) 77–94.
- FALK J., "Weimar, Montag Nachmittags d. 19. Dzbr. 1803" in Schmidt E. (ed.), *Herder im geistlichen Amt. Untersuchungen / Quellen / Dokumente* (Leipzig: 1956) 265–268.
- , "Nachrufe", *Zeitung für die elegante Welt* (December 19th, 1803) 1241 and (January 3rd, 1804) 3.
- FÖGEN T., "Tears and Crying in Graeco-Roman Antiquity: An Introduction", in Fögen T. (ed.), *Tears in the Graeco-Roman World* (Berlin: 2009) 1–16.
- FOSTER M., *Lectures on the History of Physiology during the Sixteenth, Seventeenth and Eighteenth Centuries* (Cambridge: 1907).
- FRANK A.W., *The Renewal of Generosity. Illness, Medicine, and How to Live* (Chicago: 2004).
- GALEN, *Galen on Food and Diet*, tr. Grant M. (London-New York: 2000).
- GENSCHOREK W., *Christoph Wilhelm Hufeland. Der Arzt, der das Leben verlängern half* (Leipzig: 1986).
- GESCHE A., *Sprache und die Natur des Menschen* (Weimar: 1993).
- Goethe J.W. von, *Aus meinem Leben. Dichtung und Wahrheit. Zweite Abtheilung*, 4 vols. (Tübingen: 1816).
- HÄFNER R., "‘L’âme est une neurologie en miniature’: Herder und die Neurophysiologie Charles Bonnets", in Schings H.-J. (ed.), *Der ganze Mensch. Anthropologie und Literatur im 18. Jahrhundert* (Stuttgart: 1994) 391–409.

- HAGNER M., "The Soul and the Brain between Anatomy and Naturphilosophie in the Early Nineteenth Century", *Medical History* 36 (1992) 1–33.
- HAHN K.-H. (ed.), *Briefe an Goethe. Gesamtausgabe in Regestform*, 2 vols. (Weimar: 1981).
- , (ed.), *Briefe. Gesamtausgabe*, 1763–1803, 9 vols. (Weimar: 1984).
- HALL T.S., *Ideas of Life and Matter*, 2 vols. (Chicago: 1969).
- HALLER ALBRECHT VON, *Anfangsgründe der Physiologie des menschlichen Körpers*, tr. Haller J.S., 6 vols. (Berlin, Christian Friedrich Voss: 1762) [Lat. 1757].
- HAYM R., *Herder nach seinem Leben und seinen Werken dargestellt*, 2 vols. (Berlin: 1954<sup>2</sup>).
- HERDER JOHANN GOTTFRIED VON, *Blue Study Book* (Ms. Königsberg: 1762–1766) [in: Capsule XX; AHN; of the Manuscript and Incunables Collection of the Berlin State Library; Culture Forum].
- , *Brown Book* (Ms. Königsberg and Riga) in 1765 [in: Capsule XXI; AHN, of the Manuscript and Incunables Collection of the Berlin State Library; Culture Forum].
- , "Kritische Wälder: Oder Betrachtungen, die Wissenschaft und Kunst des Schönen betreffend: Erstes Wäldchen XI. Herrn Lessings Laokoon gewidmet (1769)", in Suphan B. (ed.), *Herder. Sämtliche Werke* (Berlin: 1883), vol. 3, 155–280.
- HESS V., *Von der semiotischen zur diagnostischen Medizin. Die Entstehung der klinischen Methode zwischen 1750 und 1850* (Husum: 1993) 31–33.
- HUFELAND CHRISTOPH WILHELM, *Die Kunst, das Leben zu verlängern* (Jena, Akademische Verlagsbuchhandlung: 1797).
- JUVENAL, *Saturae*: eds. Green P. – Walker B. (1974), *Satires*, London.
- KESSLER M., *Johann Gottfried Herder, der Theologe unter den Klassikern. Das Amt des General-Superintendenten von Sachsen-Weimar* (Berlin-New York: 2007).
- KÖPKE W., "Truth and Revelation: On Herder's Theological Writings", in Köpke W. – Kroll S.B. (eds.), *Johann Gottfried Herder. Innovator through the Ages* (Bonn: 1982) 140–159.
- KOHLHAGEN N. – SUNNUS S., *Eine Liebe in Weimar. Caroline Flachsland und Johann Gottfried Herder* (Stuttgart: 1994<sup>2</sup>).
- LESCH J.E., *Science and Medicine in France. The Emergence of Experimental Physiology, 1790–1855* (Cambridge: 1984).
- LESKY E., "Gall und Herder", *Clio Medica* 2 (1967) 85–96.
- MINOR J.M. Le, "The Chair of Anatomy in the Faculty of Medicine at Strasbourg: 350th Anniversary of its Foundation", *Surgical and Radiological Anatomy* 24 (2002) 1–5.
- MINTER C.J., "Literary 'Empfindsamkeit' and Nervous Sensibility in Eighteenth-Century Germany", *The Modern Language Review* 96 (2001) 1016–1028.
- NISBET H.B., *Herder and the Philosophy and History of Science* (Cambridge: 1970).
- , "Naturgeschichte und Humangeschichte bei Goethe, Herder und Kant", in Matussek P. (ed.), *Goethe und die Verzeitlichung der Natur* (Munich: 1998) 15–43.
- NUTTON V., "Physiologia: From Galen to Jacob Bording", in Horstmanshoff M. – King H. – Zittel C. (eds.), *Blood, Sweat and Tears. The Changing Concepts of Physiology from Antiquity into Early Modern Europe* (Leiden: 2011) 27–40.
- OWREN H., *Herders Bildungsprogramm und seine Auswirkungen im 18. und 19. Jahrhundert* (Heidelberg: 1985).
- PATEL B., "Management of Acquired Nasolacrimal Duct Obstruction: External and Endonasal Dacryocystorhinostomy: Is there a Third Way?", *British Journal of Ophthalmology* 93 (2009) 1438–1443.
- PLANTINGA A., "Evolution, Epiphenomenalism, Reductionism", *Philosophy and Phenomenological Research* 68 (2004) 602–619.
- PROSS W., "Haller und die Aufklärung", in Steinke H. – Boschung U. – Pross W. (eds.), *Albrecht von Haller. Leben. Werk. Epoche* (Göttingen: 2008) 415–460.
- , "Herders Konzept der organischen Kräfte und die Wirkung der Ideen zur Philosophie der Geschichte der Menschheit auf Carl Friedrich Kielmeyer", in Kanz K.T. (ed.), *Philosophie des Organischen in der Goethezeit. Studien zu Werk und Wirkung des Naturforschers Carl Friedrich Kielmeyer (1765–1844)* (Stuttgart: 1994) 81–99.
- , (ed.), *Johann Gottfried Herder. Werke*, 3 vols. (Munich: 1984–2002).

- RICHTER S., "Medizinischer und ästhetischer Diskurs im 18. Jahrhundert: Herder und Haller über Reiz", *Lessing Yearbook* 25 (1993) 83–95.
- ROTHSCHUH K.E., *History of Physiology* (Huntington, NY: 1973) [Germ. 1968, tr. Risse G.B.].
- ROUSSEAU G.S., "Nerves, Spirits, and Fibres: Towards Defining the Origins of Sensibility", in Brissenden R.F. – Eade J.C. (eds.), *Studies in the Eighteenth Century, Bd. III, Papers presented at the Third David Nichol Smith Memorial Seminar, Canberra 1973* (Toronto: 1973) 137–157.
- , (ed.), *The Languages of Psyche: Mind and Body in Enlightenment Thought* (Berkeley-Los Angeles-Oxford: 1990).
- RUISINGER M., "Der flüssige Kristall. Anatomische Forschung und therapeutische Praxis bei Lorenz Heister (1683–1758) am Beispiel des Starleidens", in Helm J. – Stukenbrock K. (eds.), *Anatomie. Sektionen einer medizinischen Wissenschaft im 18. Jahrhundert* (Stuttgart: 2003) 101–125.
- RUPRECHT E., "Herders Gedanken Über die Seele und ihre Unsterblichkeit", in Poschmann B. (ed.), *Bückerburger Gespräche über Johann Gottfried Herder 1979* (Bückerburg: 1980).
- SARASIN P., *Reizbare Maschinen. Eine Geschichte des Körpers 1765–1914* (Frankfurt: 2001).
- SCHAUER H. (ed.), *Herders Briefwechsel mit Caroline Flachsland. Nach den Handschriften des Goethe- und Schillerarchivs, Schriften der Goethe-Gesellschaft* 39, 2 vols. (Weimar: 1928).
- SCHILLER J., *Physiologie et classification. Relations historiques* (Paris: 1980).
- SCHMIDGEN H. – GEIMER P. – DIERIG S. (eds.), *Kultur im Experiment* (Berlin: 2004).
- SOBOTH C., "Tränen des Auges, Tränen des Herzens: Anatomien des Weinens in Pietismus, Aufklärung und Empfindsamkeit", in Helm J. – Stukenbrock K. (eds.), *Anatomie. Sektionen einer medizinischen Wissenschaft im 18. Jahrhundert* (Stuttgart: 2003) 293–315.
- STAHNISCHE F., "'Dieu et cerveau, rien que Dieu et cerveau': Johann Gottfried von Herder (1744–1803) und die Neurowissenschaften seiner Zeit", *Würzburger medizinhistorische Mitteilungen* 26 (2007) 124–165.
- , "Herders 'anthropologische Physiologie' und die 'Hallesche Psychomedizin': Zum Verhältnis von Körpervorstellung, Religion und Therapie im 18. Jahrhundert", in Sträter U. – Lehmann H. – Müller-Bahlke T. – Soboth C. – Wallmann J. (eds.), *Die 'Neue Kreatur'. Pietismus und Anthropologie. Interdisziplinäre Pietismusforschungen. Beiträge zum Zweiten Internationalen Kongress für Pietismusforschung 2005* (Tübingen: 2009) 821–834.
- , *Ideas in Action. Der Funktionsbegriff und seine methodologische Rolle im Forschungsprogramm des Experimentalphysiologen François Magendie (1783–1855)* (Münster-Hamburg-London: 2003).
- , "Über die neuronale Natur des Weiblichen: Szientismus und Geschlechterdifferenz in der anatomischen Hirnforschung (1760–1850)", in Stahnisch F. – Steger F. (eds.), *Medizin, Geschichte und Geschlecht. Körperhistorische Rekonstruktionen von Identitäten und Differenzen* (Stuttgart: 2005) 197–224.
- STEINKE H., *Irritating Experiments. Haller's Concept and the European Controversy on Irritability and Sensibility, 1750–1790* (Union, NJ-Amsterdam: 2005).
- STIFTUNG WEIMARER KLASSIK (ed.), *Johann Gottfried Herder. Briefe*, ed. Dobbek W. – Arnold G. (Weimar: 1996).
- STOLBERG M., *Homo patiens. Krankheits- und Körpererfahrung in der Frühen Neuzeit* (Cologne: 2003).
- SUPHAN B. (ed.), *Sämtliche Werke* (Berlin: 1883).
- TANSEY E.M., "The Physiological Tradition", in Bynum W.F. – Porter R. (eds.), *Companion Encyclopaedia of the History of Medicine* (London-New York: 1996) 120–152.
- TÖLLNER R., *Albrecht von Haller. Über die Einheit im Denken des letzten Universalgelehrten* (Wiesbaden: 1971).
- , "Zur Deutung der 'Fragmente Religiöser Empfindungen'", in Steinke H. – Boschung U. – Pross W. (eds.), *Albrecht von Haller. Leben. Werk. Epoche* (Göttingen: 2008) 485–496.
- UNGER R. (ed.), *Gesammelte Studien. Zur Dichtungs- und Geistesgeschichte der Goethezeit* (Darmstadt: 1966), vol. 3.

- VIEHMEYER L.A., "Abraham Wagner and George de Benneville: Physicians of Body and Soul", in Helm J. – Wilson R. (eds.), *Medical Theory and Therapeutic Practice in the Eighteenth Century. A Transatlantic Perspective* (Stuttgart: 2008).
- VINGERHOETS A.J.J.M. – BYLSMA L.M. – ROTTENBERG J., "Crying: A Biopsychosocial Phenomenon", in Fögen T. (ed.), *Tears in the Graeco-Roman World* (Berlin: 2009) 439–475.
- WAPNEWSKI P., "Herders Leiden", in Dietze W. – Dahnke H.-D. – Goldammer P. – Hahn K.-H. – Otto R. (eds.), *Herder Kolloquium, Referate und Diskussionsbeiträge 1978* (Weimar: 1980) 1001–1016.
- WERB A., "The History and Development of Lacrimal Surgery in England and Europe", *Advances in Ophthalmic Plastic and Reconstructive Surgery* 5 (1986) 233–240.
- WITTERN R., "Natur kontra Naturwissenschaft: Zur Auseinandersetzung zwischen Naturheilkunde und Schulmedizin im späten 19. Jahrhundert", *Erlanger Universitätsreden* 37 (1992) 7.
- ZAREMBA M., *Johann Gottfried Herder. Prediger der Humanität* (Cologne: 2002).
- ZINK C., "Dacrocystitis Congenita", in Zink C. – Engst R. – Kriwet V. – Schäbl H. – Spitzer T. – Weimann A. – Wolters J.-W. (eds.), *Psyhyrembel klinisches Wörterbuch mit klinischen Syndromen und Nomina Anatomica* (Berlin-New York: 1986<sup>255</sup>) 321.
- ZUNCKEL J.G., "Gedächtnisrede am Grabe Sr. Hochwüird. Magnificenz des Herrn Präsidenten von Herder gesprochen am 21sten Dezember 1803", in Schmidt E. (ed.), *Herder im geistlichen Amt. Untersuchungen / Quellen / Dokumente* (Leipzig: 1956) 275–281.

PART FIVE

BODY AND SOUL





FROM DOUBT TO CERTAINTY.  
ASPECTS OF THE CONCEPTUALISATION AND INTERPRETATION  
OF GALEN'S NATURAL PNEUMA

Julius Rocca

*For Jutta Kollesch*

*Summary\**

The physician-philosopher Galen of Pergamum (129–ca. 216/217 AD) was one of the foremost exponents of anatomical science. His achievements in this field, and its influence, have been the subject of significant and abiding interest. In contrast, Galen's functional anatomy or physiology has not, until relatively recently, received comparable attention. This is unfortunate as Galenic physiology was not only greatly influential, but was also, due to *Galenism's* subsequent and relentless drive to codify, almost uniformly misrepresented from its inception. Much of the secondary literature on the subject, with few exceptions, has also perpetuated this distortion; specifically, that Galen conceived of a functioning tripartite pneumatology. Whilst it is true that Galen does mention natural pneuma, he does so only once, and in deliberately vague terms. However, Galenic physiology was interpreted and transmitted as a fully operational tripartite system. The purpose of this chapter is to present Galen's physiology in its own terms, and to outline aspects of its transmission focussing on the pivotal role of Ḥunayn ibn Isḥāq in particular. Such an examination is not only instructive in purely historical terms, but should serve as a salutary reminder, by virtue of the length of its transmission, of the power and longevity of pneuma as an analogical model, especially in non-experimental physiological systems.

*Spiritus igitur sunt tres, primus naturalis qui sumit principium ab epate, secundus  
vitalis a corde, tertius animalis a cerebro.*

Isagoge Ioannitius, Articella 2 recto

---

\* I am most grateful to the editors, especially Helen King, for their invaluable assistance, and the anonymous referees for their constructive criticism. I would also like to thank Peter Pormann for his helpful comments and allowing me to see his forthcoming chapter in *Medical Education in Late Antiquity*, and to Vivian Nutton, for, as ever, insightful advice and suggestions. Finally, I owe a debt to Jutta Kollesch, external examiner of my doctoral thesis, to whom this chapter is humbly offered in appreciation.

### Introduction

Robert Burton's (1577–1640) *The Anatomy of Melancholy* (1621), that magnificent account of the human condition, cites a then-physiological commonplace regarding the number and function of *pneumata* or *spirits*, which goes as follows:

Of these spirits there be three kinds, according to the three principal parts, brain, heart and liver; natural, vital, animal. The natural are begotten in the liver and there dispersed through the veins to perform those natural actions. The vital spirits are made in the heart, of the natural, which (vital spirits) by the arteries are transported to all the other parts: if the spirits cease, then life ceaseth, as in a syncope or swooning. The animal spirits, formed of the vital, brought up to the brain and diffused by the nerves to the subordinate members, give sense and motion to them all.<sup>1</sup>

Yet within three decades, in 1649, in the *Second Essay to Jean Riolan*, William Harvey would write:

With regard to [...] spirits, there are many and opposing views as to which these are, and what is their state in the body, and their consistence, and whether they are separate and distinct from blood and the solid parts, or mixed with these. So it is not surprising that these spirits, with their nature thus left in doubt, serve as a common subterfuge of ignorance. For smatterers, not knowing what causes to assign to a happening, promptly say that the spirits are responsible (thus introducing them upon every occasion). And like bad poets, they call this *deus ex machina* on to their stage to explain their plot and catastrophe.<sup>2</sup>

If, by the Early Modern period, a tripartite physiological pneumatology had been a mainstay of Western medicine for almost eight centuries, then the era also represented its *terminus ad quem*. Its progenitor was commonly held to have been the physician-philosopher Galen of Pergamum (129–ca. 216/217 AD).<sup>3</sup> The notion of three functioning Galenic *pneumata* is a familiar story in a number of twentieth-century medical historical texts.<sup>4</sup> Yet Galen's role in the shaping of one part of this triad, the *natural*

<sup>1</sup> Burton Robert, *The Anatomy of Melancholy* (Oxford: 1638<sup>s</sup>), vol. I, 1,ii,2.

<sup>2</sup> Cited in Bono J.J., *The Word of God and the Languages of Man* (Madison: 1995), vol. 1, 86.

<sup>3</sup> A comprehensive overview is that of Hankinson R.J. (ed.), *The Cambridge Companion to Galen* (Cambridge: 2008).

<sup>4</sup> For an analysis see Rocca J., *Genesis, Elaboration and Differentiation in Galen's Pneumatologies* (PhD. diss. Sydney: 1995), chapter 2.

pneuma, had already been called into question in 1895.<sup>5</sup> Half a century later, in 1951, Owsei Temkin's seminal paper also pointed the way to a new understanding of Galen's handling of pneuma, pointing out that Galen never conceived a tripartite pneumatic scheme. As will be shown below, focussing on the status of natural pneuma in particular, such a scheme was formally laid down, albeit not created, by the great Nestorian Christian physician, philologist and translator, Ḥunayn Ibn Isḥāq in the ninth century. From his hands it passed, in an abridged, truncated form known as the *Isagoge*, to Constantine the African, and filtered throughout the West via the influential School of Salerno. It was Ḥunayn who, expanding a single citation from Galen, where three pneumata are mentioned, but only the psychic form unambiguously referred to, formally welded a completely tripartite pneumatic template, which when combined with Galen's authority, reputation and influence, to say nothing of the 'multiplicity of meanings'<sup>6</sup> of the term *pneuma* (or *spiritus*), was largely responsible for the particular physiological theorem it embodied becoming the dominant paradigm in Western medicine until the Early Modern period. Even today it is still sometimes referred to as Galen's own construct. The purpose of this chapter will be to examine the context of Galen's single citation of natural pneuma, provide an overview of his pneumatic physiology, overview the later establishment of a tripartite pneumatic schema, and conclude with some general remarks on medical pneumatology up to the Early Modern period. In so doing, it will be seen how an attractive and simple analogical model such as pneuma developed not only into a major physiological paradigm, but one whose very adaptive capacities made possible a number of physiological understandings, to say nothing of its psychological, cosmological, and theological interpretations.<sup>7</sup> Above all, the concept of pneuma shows how, until the nineteenth century, physiology still viewed itself as a discipline indissolubly wedded to philosophy; to a principally narrative discourse which did not regard itself as an experimental science.<sup>8</sup>

<sup>5</sup> Wellmann M., *Die pneumatische Schule. Bis auf Archigenes* (Berlin: 1895) 65–84.

<sup>6</sup> Bono J.J., "Medical Spirits and the Medieval Language of Life", *Traditio* XL (1984) 91.

<sup>7</sup> 'Particularly during the sixteenth century *spiritus* was often central to discussions of the imagination and of the "occult" origins of madness or acute psychological disorders.' Bono, "Medical Spirits" 94.

<sup>8</sup> See the important study by Cunningham A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.

*Galen and the case of natural pneuma*

The fifth chapter of the twelfth book of Galen's masterwork of medical theory and practice, *On the Therapeutic Method*, a work widely diffused in Europe following Thomas Linacre's 1519 Latin translation, is devoted to a discussion of *syncope*. Embedded in this argument is the only mention in the extant Galenic corpus of anything resembling a tripartite system of pneumatic physiology, mirroring, so it has been assumed, Galen's Platonically-derived tripartite psychology of the soul. The citation is as follows:

Of the psychic pneuma (*pneumatōs psuchikou*), we have clearly demonstrated that for instance, the brain is its well-head, and it is watered and nourished both by inspiration and by the retiform plexus. But in respect of the vital pneuma (*pneumatōs zōtikou*), the demonstration was not equally as clear, yet it appears at any rate not unlikely for it to be encompassed by the heart itself and the arteries and that it is especially nourished from respiration but also by blood. And if there is also a certain natural pneuma (*pneuma phusikon*), it should be confined to the liver and the veins.<sup>9</sup>

Here, Galen is very careful not to define any specific role for the natural pneuma (*pneuma phusikon*). Its very existence is couched in deliberately ambiguous language. In his discussion of syncope, from which the above citation forms a part, Galen defines the term as a sudden collapse of our powers or faculties (*dunameis*), and refers in general terms to a 'pneumatic substance', which, together with the particular temperament of the solid parts of the organ concerned, constitutes its faculties. According to Galen, it is the loss or alteration of this pneumatic substance, by external poisons, bad external air, humoral dyscrasias, depletion of food or breath, or abnormal psychic states, such as pain or sleeplessness, that can trigger a syncopal episode. By qualifying his discussion on the pneumatic causation of syncope in this way, Galen leaves his reader none the wiser as to which particular pneuma he holds responsible. Since the nature of Galen's pneumatic physiology is, of course, ultimately theoretical, but is also grounded in, and dependent upon, anatomical demonstration, this ambivalence is quite intentional at least as far as the existence of a natural pneuma is concerned, and which shall be noted below.

---

<sup>9</sup> Galenus, *De methodo medendi* 12.5 (10.839–840 K.). Unless otherwise stated, Galen is cited according to the edition of Kühn C.G. (ed.), *Opera omnia* (Leipzig: 1821–1833), together with references to the critical editions (where these exist).

Galen's analogical model in the above citation is nutritional: the psychic and vital pneumata are described in terms of their sources of sustenance and nourishment, whilst, tellingly, the natural pneuma is not. Indeed, Galen goes on to state that correct attention to nutritional sources helps in the treatment and prevention of syncope. Yet it is possible to take this nutritional analogy together with the citation of three pneumata, and by conflating both, ground the existence of natural pneuma in nutritive terms. Later commentators undertook this step. For after all, Galen describes in detail the processes of digestion and how their products are converted to blood in the liver and the veins.<sup>10</sup> It therefore seemed reasonable to underwrite the functional capacities of the liver in pneumatic terms. As Harris writes, 'since the operative power of the psychic faculties is the psychic spirit, and that of the vital faculties the vital spirit, it would seem to be quite logical to assume that the 'natural faculties' are operated by a "natural" spirit'.<sup>11</sup> Galen's terse and singular description of the natural pneuma, therefore, was tailor-made for such speculative accretions, and in providing ample opportunity for interpretation, systematisation and codification, made possible the development of a fully-fledged tripartite physiological pneumatology.

### *Galen's pneumatic physiology*

In *On the Utility of the Parts*, one of Western medicine's masterworks of teleological functional anatomy, and Antiquity's largest surviving work of its kind, Galen provides a concise and unambiguous account of where pneumata are elaborated, and how many are employed:

The outside air (pneuma) which is first drawn in by the rough arteries receives its first elaboration in the flesh of the lungs, its second in the heart and the arteries, especially those of the retiform plexus, and then a final elaboration in the ventricles of the brain, which completes its transformation into psychic pneuma.<sup>12</sup>

<sup>10</sup> The role of the veins in the production of blood is stressed repeatedly in *On the Natural Faculties*, whilst the liver is not specifically linked with blood production by itself (*De facultatibus naturalibus* 2.9, 2.117 and 129 K.). The liver's role in blood production is however discussed in *De usu partium* 4.3 (1.197–198 Helmreich; 3.269–270 K.).

<sup>11</sup> Harris C.R.S., *The Heart and the Vascular System in Ancient Greek Medicine. From Alcmaeon to Galen* (Oxford: 1973) 352.

<sup>12</sup> Galen, *De usu part.* 7.8 (1.393–394 Helmreich; 3.541–542 K.). The text is cited according to the edition of Helmreich G., *Galen. De Usu Partium Libri XVII* (Leipzig: 1907, 1909).

Galen's detailed ventricular and nerve experiments are absolutely dependent on a pneuma-based physiology, and his use of pneuma relies in its turn on meticulously-delineated anatomical structures whose perceived functions are elucidated according to a methodology of empirical investigation.<sup>13</sup> Galen's choice of pneuma is not entirely surprising. It has a long pedigree in Greek philosophy and exerted a significant influence on physical as well as psychological theories. In this respect, Galen's often violent duelling with his peers – past and contemporaneous – takes place against a background in which the deterministic, qualitative, and teleological aspects of pneuma theories are set against the indeterminism of other matter theories – principally atomistic or particulate ones. Given Galen's strong teleological stance, his holding of any indeterminate matter theory would have been out of the question. Pneuma is thus a perfectly suitable choice. It is indeterminate, invisible, and, above all, malleable, and may be defined and presented in a number of ways.<sup>14</sup> Among the Presocratic natural philosophers, Anaximenes apparently equated pneuma with the outside air and identified it with the life-principle. Diogenes of Apollonia seems to have made the first explicit equating of air with the soul and intelligence. This life-giving air is distributed about the body in a carrier system, the *blood vessels*. The air so distributed with the blood throughout the entire body somehow enables cognition to take place.<sup>15</sup> Pneuma in the Hippocratic Corpus seems to broadly reflect its assumed role in physiological processes. The anonymous author of *The Sacred Disease* holds that certain blood vessels take in most of the outside air, distributing it through the body. This breath cools the body and some also goes straight to the brain, where it is responsible for intelligence and motion.<sup>16</sup> These texts presented certain general themes, which were capable of lending themselves to further refinement: inspired air as the source of pneuma; the vasculature as its carrier system, and, most significantly, the use of air or pneuma to account for sensation and voluntary motion. It was the Stoics who further codified pneuma. For them, pneuma was regarded

<sup>13</sup> See Rocca J., *Galen on the Brain. Anatomical Knowledge and Physiological Speculation in the Second Century A.D.* (Leiden: 2003) 49–78.

<sup>14</sup> The locus classicus is Verbeke G., *L'Évolution de la doctrine du pneuma du stoïcisme à S. Augustin: étude philosophique* (Paris: 1945) 206–220. See also Onians R.B., *The Origins of European Thought about the Body, the Mind, the Soul, the World, Time and Fate* (Cambridge: 1951) 54, 54–56, 76–77, 168–172, 250–252.

<sup>15</sup> For an analysis and translation of the relevant fragments, see Kirk G.S. – Raven J.E. – Schofield M., *The Presocratic Philosophers* (Cambridge: 1991<sup>2</sup>) 158–161, 442–450.

<sup>16</sup> Hippocrates, *De morbo sacro* 16 (86 Grensemann; 6.390–392 L.); 7 (72 Grensemann; 6.372 L.).



either as a special compound of fire and air, and this explicit identification is Stoic in origin (*Stoicorum veterum fragmenta* 2.310, 389, 439), or as vital heat itself (*Stoicorum veterum fragmenta* 1.135). Pneuma could be used to underpin a variety of explanations, from material causation to the psychic attributes of the soul itself. On inspiration it provides the vital force and psychic agency of the body, and operates as the fundamental principle of coherence. And while Stoic terminology provided neither a set of types of pneuma, nor an exposition of a specialised physiological theory, Stoic pneuma was capable of alteration or change, and under later Stoic embryology developed into a more formalised set of pneumatic differentiae. According to Plutarch, Chrysippus maintained that pneuma in the foetus was changed at birth by the outside air to become 'vital pneuma', held to be the equivalent of soul (*Stoicorum veterum fragmenta* 2.806). This broad notion of pneumatic differentiation is one which Galen will exploit. But the Stoics, unlike Galen, did not utilise the concept of a *qualitative* change in pneuma. The pneuma of the growing Stoic embryo is said to be natural (*phusis*). At gestation it changes its status, becoming vital (Chrysippus ap. Plutarch, *Stoic Self-contradictions* 1052F). As the human being grows, what is now referred to as psychic pneuma is held to be responsible for consciousness (*Stoicorum veterum fragmenta* 2.716). The mechanism behind these changes is ascribed to an alteration in the tension (*tonos*) of pneuma, which accounts for the activities of the living being (*Stoicorum veterum fragmenta* 2.393, 458). Yet although the Stoics used the term psychic pneuma, and changes in its tensional state were said to account for individual action, pneuma was not grounded in any specific organ. But Stoicism's role in the history of medical pneumatology is crucial: it underwrote the transformation of pneuma from a purely general principle of animation to one adaptable to more specialised physiological needs, and thereby helped render more acceptable the notion of pneuma as a physiological agent.<sup>17</sup>

By the Hellenistic period, then, a distinction appears to be being drawn between *natural pneuma* (responsible for all life functions) and *psychic pneuma* (responsible for all nervous actions). The great Alexandrian medical pioneers, Herophilus and Erasistratus, according to Galen, also regarded pneuma as acquired through respiration.<sup>18</sup> Herophilus's use of pneuma is problematic in that he allegedly refers to the optic nerves as

<sup>17</sup> See Rocca, *Galen on the Brain* 60–62.

<sup>18</sup> Galenus, *An in arteriis natura sanguis contineatur* 2 (146–148 Furley-Wilkie; 4.706–707 K.).

containing *natural pneuma*, and would appear not to have employed the term *psychic pneuma* in any way.<sup>19</sup> If this is so, then Herophilus may well have felt comfortable regarding natural pneuma being used both as a general as well as specific physiological principle. When psychic pneuma entered the medical lexicon cannot be precisely known, although Galen, in *On the Doctrines of Hippocrates and Plato*, states that the distinction between a vital pneuma (located in the heart), and a psychic pneuma (located in the brain) was known to Erasistratus, Herophilus's younger contemporary.<sup>20</sup> Erasistratus seems to have been more interested in the physiological aspects of pneuma than his senior colleague. In *De usu respirationis* (*On the Use of Breathing*), Erasistratus and his school are said by Galen to have maintained that the pneuma in the heart was the source of the brain's psychic pneuma. Galen probably adapted this general Erasistratean thesis when he discusses the transformation of vital pneuma (via the heart) to psychic pneuma in the brain, via the elaborating agencies of two other vascular structures there—the retiform and choroid plexuses—rather than the meninges, as Erasistratus held.<sup>21</sup> But the major point of contention between Galen and Erasistratus lies in the latter's regarding pneumatic differentiation as a *quantitative* process, with pneuma becoming increasingly finer.<sup>22</sup> In contrast to this Stoic type of conceptualisation, Galen's physiology is absolutely based on pneuma that is subject to a series of qualitative changes, the better to highlight the functional capacities of the relevant organ in question. To what extent another Hellenistic source of pneuma theory, that advocated by the so-called Pneumatist sect, contributed to Galen's understanding and deployment of pneuma, is difficult to determine.<sup>23</sup>

Galen never rules out an external source of pneuma; it does after all play some part in the generation of psychic pneuma.<sup>24</sup> Yet the mainstay of Galen's pneumatic physiology lies in a progressive elaboration of pneuma-like material substrate by several discrete anatomical structures.

<sup>19</sup> See Staden H. von, *Herophilus. The Art of Medicine in Early Alexandria* (Cambridge: 1989) 253–255.

<sup>20</sup> Galenus, *De placitis Hippocratis et Platonis* 2.8 (164,13–16 de Lacy; 5,281 K.).

<sup>21</sup> See Rocca, *Galen on the Brain* 38–40.

<sup>22</sup> See Harris, *The Heart* 225.

<sup>23</sup> As Nutton V., *Ancient Medicine* (London-New York: 2004) 206, comments, 'the fluidity of Pneumatist doctrines and the obvious tendency towards eclecticism manifested, among others, by Agathinus and Archigenes place difficulties in the way of any clear estimate of the extent and influence of Pneumatism'. The fundamental study of this sect remains that of Wellmann. A new examination is a desideratum.

<sup>24</sup> See Rocca, *Galen on the Brain* 224–234.

For Galen, the creation of psychic pneuma begins when inspired air enters the lungs, which alter it.<sup>25</sup> From the lungs, this 'pneuma-like' (*pneumatôdes*) substance enters the left ventricle of the heart where it is fully elaborated into vital pneuma. This change is made possible by *innate heat* within the left ventricle, acting in concert with altered venous blood from the right ventricle. For Galen, innate heat was an indispensable part of any elaborative process, whether of blood, humour or pneuma.<sup>26</sup> The left ventricle is regarded by him as the chief repository for the body's innate heat (*On the Utility of the Parts* 6.16 (I.355,1 Helmreich; 3.487 K.)). To emphasise the link between blood and pneuma, the left ventricle is described by Galen as *pneumatic* (*pneumatikê*). It is where the yellow, warm, and fine pneuma-like blood is generated and sent out to the rest of the body via the arteries (Galen, *On the Doctrines of Hippocrates and Plato* 6.8 (414,30–33 de Lacy; 5.572–573 K.)). The ingredients required to elaborate vital pneuma are therefore blood, the pneuma-like substance, and innate heat, but how they are combined is not made explicit. The entire process is, however, made analogous to coction (*On the Doctrines of Hippocrates and Plato* 10.7 (528,11–14 de Lacy; 5.707 K.)). Galen's vital pneuma now has access to the arterial system, affording it entry to the brain where it infuses the *retiform plexus*, a network of fine arteries at the base of the brain, and the *choroid plexuses*, a cluster of veins and arteries in the ventricular system. These complete the transformation of vital to psychic pneuma.<sup>27</sup> However, Galen also allows the ventricles to elaborate a certain amount of outside air through the nasal passages, especially if there is interruption to the supply of vital pneuma via the carotid arteries.<sup>28</sup> The ventricles are the final repository of psychic pneuma, which then continues through the nerves and thence to the rest of the body, providing sensation and voluntary motion. How these occur is never fully determined by Galen, although the late text tellingly entitled *On Problematic Movements* sees him wrestling with the problem from a number of perspectives.<sup>29</sup> Precisely how pneuma ultimately functions is a question that Galen never resolves since it is insoluble with the epistemological

<sup>25</sup> Galen, *De plac. Hipp. et Plat.* 8.8 (528,28–32 de Lacy; 5.707–709 K.).

<sup>26</sup> See Durling R.J., "The Innate Heat in Galen", *Medizinhistorisches Journal* 23 (1988) 210–212.

<sup>27</sup> See Rocca, *Galen on the Brain* 219–224.

<sup>28</sup> See Rocca, *Galen on the Brain* 224–234.

<sup>29</sup> See the preliminary study by Debru A., "Galen on the Unclear Movements", in Nutton V. (ed.), *The Unknown Galen* (London: 2002) 79–85, and the critical edition and translation by Nutton V., *Galen. On Problematical Movements* (Cambridge: 2011).

tools at hand. And Galen, to his credit, realises this. At most, he is able only to interpret the results of his ventricular and nerve experiments as seeming to reveal the presence of something that Galen and others call 'psychic pneuma'.

*Pneuma, governing powers, and the soul*

Galen tells us that there are three sources (*archai*) which govern our rational, spirited and desiderative selves, housed respectively in the brain, heart and liver (*On the Doctrines of Hippocrates and Plato* 7.3 (438,28–440,8 de Lacy; 5.600–601 K.)).<sup>30</sup> The brain is responsible for sensation and voluntary motion; the heart controls the source of warmth (via its control of the innate heat within the left ventricle) and of pulsation in the arteries. Thirdly, the faculty in the liver is responsible for nutrition. At the *psychic level*, what appears to be the familiar Platonic tripartition of faculties is delineated: the rational functions of the brain, and the spirited and appetitive drives centred around heart and liver respectively. Plato of course never explicitly states that the desiderative power resides in the liver; at *Timaeus* 70d–e, he locates it between the diaphragm and the navel. Galen, however, makes the connection an explicit one in discussing the duality of functions of the faculty in the liver: it is on the one hand concerned with nutrition, on the other 'the same power' is responsible for pleasures (*On the Doctrines of Hippocrates and Plato* 7.3 (440,6–8 de Lacy; 5.601 K.)). This is a point repeated in *On the Therapeutic Method* (9.10, 10.635 K.) where the power or faculty of the liver is employed to account for the psychological role of desire and the physiological one of nutrition (and also reproduction). Any absolute necessity for a natural pneuma is thereby avoided.

As with Aristotle, from whom he takes the term, Galen held that each *homoeomerous* part of the body (that elemental component which, however divided, retains its fundamental property or properties), such as bone and sinew, has a distinctive, innate or pre-existing power or ability (*dunamis*; *On the Natural Faculties* 2.3 (2.80 and 101 K.)). In terms of nutrition alone, it might stand to reason – as it certainly did for later commentators –

---

<sup>30</sup> A view Galen significantly reiterates in his last work, *De propr. plac.* 8.3 (180,15–17 Boudon-Millot – Pietrobelli; 82,9–10 Nutton).

that the natural pneuma should have some assigned role, since the liver is Galen's seat of nutrition, and of the end product of the nutritive process, blood (*On the Natural Faculties* 3.13 (2.201 K.)). But Galen provides no elaborative mechanism for a natural pneuma: the liver and veins are the sites of blood, not pneumatic production. If, however, Galenists believed it was Galen's brief to give a physiological mirroring to the Platonic psychological tripartition of the faculties of soul, then linking natural pneuma to the desiderative power in the liver becomes inevitable. Galen, following Plato, placed the three faculties or powers of the soul in the brain, heart, and liver, and sought to provide an explanation for their psychological effects in physiological terms.<sup>31</sup> But having described the psychic pneuma as the 'first instrument' of the rational soul, and housing these faculties or parts, in the brain, heart, and liver, Galen does not follow this up by granting equal merit, much less attention, to the three pneumata. Neither does Galen succeed in explaining precisely how vital and psychic pneumata respectively act or influence the spirited and rational faculties, let alone a putative natural pneuma the desiderative.<sup>32</sup> Indeed, if Galen allowed discussion of a natural pneuma, then he is committed to discussing the mechanics of its relationship with the appetitive or desiderative power. The reason for such hesitancy on his part is not far to seek. It is grounded in Galen's epistemological method of anatomical demonstration, in particular his detailed dissections and vivisections of the brain and nerves. Galen also sought to demonstrate that the heart is the *archê* of the arteries, and that the arteries contain largely blood, and not air, as Erasistratus allegedly maintained. Galen also recognised the complexity of the hepatic vascular architecture. In the sixth book of *Anatomical Procedures*, he describes the structural divisions of the hepatic vein in each lobe to that of a tree, from trunk to branch to twig to fragile shoots. As far as the arterial part of the liver is concerned, May, somewhat wistfully, states:

<sup>31</sup> See Lloyd G.E.R., "Scholarship, Authority and Argument in Galen's *Quod Animi Mores*", in Manuli P. – Vegetti M. (eds.), *Le opere psicologiche di Galeno: atti del terzo colloquio galenico internazionale, Pavia, 10–12 settembre 1986* (Naples: 1988) 11–42. See also Hankinson R.J., "Body and Soul in Galen", in King R.A.H. (ed.) *Common to Body and Soul. Philosophical Approaches to Explaining Living Behaviour* (Berlin: 2006) 232–258.

<sup>32</sup> Manuli P., "La Passione nel *De placitis Hippocratis et Platonis*", in Manuli – Vegetti, *Le opere psicologiche di Galeno* 185–214, suggests that the movement of the passionate part of the soul is reflected in the expansion and contraction of the pneuma in the blood, which is in its turn a somatic representation of what is occurring at the level of the psychic faculty.

If only the hepatic artery could have been found to produce something on the order of the *rete mirabile* before entering the liver! But lacking any anatomical evidence, he was reduced to a mere suggestion that there might be some such corresponding substance as a natural pneuma. All this, of course, is pure conjecture.<sup>33</sup>

But anatomical demonstration in Galen's hands conveys not only information revealed by *autopsia*, but also involves a certain amount of experimentation, the chief tools of which for Galen are pressure, ligation and cutting. Even here, such experimentation is only achievable to a limited, verifiable extent: pressure on the ventricles of a living animal subject, for example, and the ligation and cutting of nerves yield repeatable results. The retiform plexus, crucial to the elaborative physiology of psychic pneuma, is indeed revealed by anatomy, but its function can only be inferred, and that by analogous comparison to the testicular vasculature's apparent coction of semen.<sup>34</sup> Far less certain, as Galen has indicated in the quotation cited from *On the Therapeutic Method*, cited earlier, is the demonstration as far as the heart and arteries are concerned. And the liver, as Galen knows full well, is not accessible to complete anatomical demonstration. Indeed, Galen admits that he is unable to perform any such demonstrations on that organ (*On the Doctrines of Hippocrates and Plato* 6.3 (372.32–374.8 de Lacy; 5.520–521 K.). The problem with an argument from anatomical inaccessibility is that the same question can be raised with the two organs responsible for elaborating vital pneuma, the lungs and the heart. Here, Galen cannot contrive a demonstration on as rigorous a ground as he can with the brain and the nerves. But what Galen can do is to at least provide a detailed anatomical exposition of the lungs and the heart, and, *inter alia*, point to his experiments showing that blood *and* pneuma are present in the arteries (*On whether Blood is Naturally Contained in the Arteries* 8 (4.733 K; *On Anatomical Procedures* 7.16 (2.646–650 K.)). And apart from demonstrative inaccessibility, Galen may also have been pondering the mechanism by which the liver and veins could acquire natural pneuma.<sup>35</sup> For here one may usefully cite an aspect of the physical structure of the liver itself. It is an apparently solid

<sup>33</sup> May M.T., *Galen. On the Usefulness of the Parts of the Body* (Cornell: 1968) 49.

<sup>34</sup> See Rocca, *Galen on the Brain* 212–214.

<sup>35</sup> Manuli P. – Vegetti M., *Cuore, Sangue e Cervello. Biologica e Anthropologica Nel Pensiero Antico* (Milan: 1977) 241, n. 266, comment that Galen's lack of knowledge of the natural pneuma is in part motivated by the fact that he could not overcome the difficulty of explaining just *how* the pneuma was acquired by the liver and veins. This, however, assumes that Galen is thinking along the lines of the elaboration of vital pneuma in the

organ, formed, Galen states, from blood. Since Galenic (and indeed, much of Greek) physiology characteristically is dependent on *hollow* structures such as the ventricles of the brain, the chambers of the heart, the air-filled passage of the lungs, the vasculature itself, the numerous channels and ducts of the body, as well as the purported hollowness of the nerves themselves, then the liver's architecture may well have constituted insufficient grounds for pneumatic generation.

To insist on a connection between the three faculties of soul and a tripartite pneumatology is to run the risk of granting a greater credence to natural pneuma (and to raise expectations as to what its function might be) than Galen is willing to do. To grant that natural pneuma is (perhaps) to be found in the liver and veins is one thing; to delineate its role quite another. Galen avoids any commitment to a functional concept of natural pneuma by restricting his references to the generalities of 'governing powers'. Indeed, for Galen 'the liver is the source of the type of power (*dunamis*) that is also present in plants' (*On the Doctrines of Hippocrates and Plato* 6.3 (374.9 de Lacy; 5.521 K.). The cost of this, of course, is to introduce a tension between Galen's essentially bipartite system of pneumatic physiology and soul tripartition. It would be left to later commentators to believe they could relax this tension by equating three pneumata with the three faculties of soul.

*Systematisation, codification and redaction. Galenism and the elaboration of a tripartite pneumatic physiology*

Given the importance Galen gives to a tripartite system of discrete principles or powers that govern us and which are present in the three principal organs, the brain, the heart and the liver, then by articulating a fully-formed natural pneuma or *spiritus naturalis*, later commentators could be said to have made an understandable interpretive interpolation. In other words, it is entirely plausible to place under each organ's governing power (*dunamis*) a respective pneuma. But when exactly did the notion of a tripartite system of Galenic pneumatology arise? Or to put it more narrowly, when was natural pneuma assigned an unambiguous place in the liver and the veins and could thereby be seen as available

---

heart. In the latter case, the heart however is a convenient hollow-chambered structure that the liver is not, and the cardiac elaborative analogy is thus non-transferable.



to be commanded by the liver's governing power? Although such a role for the natural pneuma appears as a consequence of the phenomenon known as *Galenism*, there can be no conclusive answer to this question as to when this happened and at whose hand. Any appeal to a putative textual tradition (if indeed one existed) raises more problems than solutions. It is perhaps better to see the gradual conceptualisation of natural pneuma as in part a consequence of the post-Galenic period's broader medical and philosophical discussions concerning pneuma and its physiological role, much as it would have formed in Galen's own time.<sup>36</sup> And to further complicate matters, Galenism should not be interpreted as a set of fixed schematics, despite its apparent adamant structure; rather, in Temkin's words, it was more of a 'changing silhouette'.<sup>37</sup> Nevertheless, it is possible to draw some tentative conclusions regarding natural pneuma's place in such a scheme.

It was inevitable that Galen's enormous body of work would at some stage be subject to some form of ordering, of codification and systematisation, to say nothing of editing such a notoriously prolix author. The result of this was the evolution of Galen's works into the medical philosophy known as *Galenism*, which is usefully defined 'as the process whereby the theories and prejudices of a second-century doctor came to dominate the whole world of medicine to such an extent that, in Greek at any rate, the vast majority of medical texts to survive in full from Antiquity are either by Galen; by followers of Galen; and by authors of whom he approved, principally Hippocrates and the Hippocratic Corpus'.<sup>38</sup> Galen, as is well known, had himself composed introductory texts on various subjects ranging from anatomy to therapeutics and also set out the order in which his works be studied.<sup>39</sup> But those who came after him realised that far more was required. Thus the efforts of the first encyclopaedists, such as Oribasius of Pergamum and Paul of Aegina, who began what

<sup>36</sup> Here one may note the mention of the pneuma in the Pseudo-Galenic *Definitiones Medicae* (*De def. med.* 73–74 (19.365–366 K.), as indicative of this broad trend. See also Harris, *The Heart* 240–241. This text, which probably dates to around the last quarter of the first century AD, is written, as the title implies, in the style of a medical memorandum. For a comprehensive analysis of this work, see Kollesch J., *Untersuchungen zu den Pseudogalenischen Definitiones Medicae* (Berlin: 1973).

<sup>37</sup> Temkin O., *Galenism. Rise and Decline of a Medical Philosophy* (Cornell: 1973) xii. Although partly dated, Temkin's survey of this phenomenon remains unsurpassed.

<sup>38</sup> Nutton V., 'Galen in Byzantium', in Grünbart M. – Kislinger E. – Muthesius A. – Stathakopoulos D.Ch. (eds.), *Material Culture and Well-Being in Byzantium (400–1453)* (Vienna: 2007) 171.

<sup>39</sup> Galen clearly sets out this agenda in his *On the Order of My Books* (19.49–61 K.).

they saw as an essential redactive process. But the formal elaboration of the Galenic *oeuvre* into *Galenism* took place in Alexandria, which, since its Hellenistic foundation, had remained a leading centre of medicine.<sup>40</sup> Medical studies in the late Alexandrian period, from the fourth century AD until the Arabic conquest in 641, centred around a curriculum which consisted of a representative sampling of the works of Hippocrates and Galen in their original, as well as student handbooks or summaries.<sup>41</sup> The evidence for this is derived from later, Arabic sources.<sup>42</sup> As far as Galen's texts were concerned, according to Ḥunayn ibn Isḥāq, twenty-four were read, and these were reordered to make the twelve books of the 'Alexandrian Canon' (other, later Arabic sources list sixteen). And again according to Ḥunayn's list, only the last 8 books of *On the Therapeutic Method* were read (the later 16 book version of the Canon has it read in its entirety).<sup>43</sup> In addition to this collection, a more accessible set of abridgments was later laid down, the so-called *Summaria Alexandrinorum*.<sup>44</sup> According to Ḥunayn's list of these Summaries, the first was Galen's own synopsis of

<sup>40</sup> For the background, see Wilson N.G., *Scholars of Byzantium* (London: 1996) 42–48. For Alexandria in the second century AD, see Staden H. von, "Galen's Alexandria", in Harris W.V. – Ruffini G. (eds.), *Ancient Alexandria between Egypt and Greece* (Leiden: 2004) 179–215.

<sup>41</sup> See Temkin O., "Geschichte des Hippokratismus im Ausgehenden Alterum", *Kyklos. Jahrbuch für Geschichte und Philosophie der Medizin* 4 (1932) especially 51–74.

<sup>42</sup> It is largely from later Arabic accounts such as Ḥunayn that the form and content of the syllabus has been ascertained. On the curriculum see Iskandar A.Z., "An Attempted Reconstruction of the Late Alexandrian Medical Curriculum", *Medical History* 20 (1976); Duffy J.M., *Ioannis Alexandrini In Hippocratis Epidemiarum Librum VI Commentarii Fragmenta*, CMG XI.1.4, 9–11. Pormann, P.E., "Medical Education in Late Antiquity: From Alexandria to Montpellier", in Horstmannshoff M. (ed.), *Hippocrates and Medical Education*, Selected Papers Presented at the XIIth International Hippocrates Colloquium. Universiteit Leiden, 24–26 August 2005. *Studies in Ancient Medicine* 35 (Leiden: 2010) 419–442, provides a succinct and lucid discussion.

<sup>43</sup> See Lieber E., "Galen in Hebrew: The Transmission of Galen's Works in the Mediaeval Islamic World", in Nutton V. (ed.), *Galen. Problems and Prospects* (London: 1981) 172–173; Savage-Smith E., "Galen's Lost Ophthalmology and the *Summaria Alexandrinorum*", in Nutton V. (ed.), *The Unknown Galen* (London: 2002) 126.

<sup>44</sup> Savage-Smith, "Galen's Lost Ophthalmology" 126–127, rightly stresses that these were two separate compendia, which have sometimes been confounded with each other. On the Summaries, see Garofalo I., "I Sommari degli Alessandrini" in Garofalo I. – Roselli A. (eds.), *Galenismo e Medicina Tardoantica Fonti Greche, Latine e Arabe*, Annali dell'Istituto Universitario Orientale de Napoli, Quaderni 7 (Naples: 2003) 203–231. Pormann P.E., "The Alexandrian Summary (Jawāmi') of Galen's *On the Sects for Beginners*: Commentary or Abridgement", in Adamson P. – Baltussen H. – Stone M.W.F. (eds.), *Philosophy, Science and Exegesis in Greek, Arabic and Latin Commentaries. Bulletin of the Institute of Classical Studies Supplement* 83 (London: 2004), vol. 2, 11–33, comments that the traditional title of "Alexandrian Summaries" is misleading.

*On the Therapeutic Method*, translated into Syriac.<sup>45</sup> Whether any of the late Alexandrian physicians who composed these works could also be termed 'Iatrosophists' in the full sense of one who lectured on medicine and philosophy has been called into question.<sup>46</sup> Nevertheless, they did share at the very least 'a common ground in physiology',<sup>47</sup> and Galen's own status as physician-philosopher would not have gone unnoticed by them. Nor, as shall be noted below, did medicine hesitate to borrow from philosophy when it came time to write compendia and related pedagogic texts.

In the commentary on Galen's *On Sects for Beginners*, ascribed to the Alexandrian physician John of Alexandria (fl. ?600–650), of whom, in common with his colleagues, very little is known, it is stated that we have within us three faculties (*virtutes*), the animal, the vital, and the natural: *tres namque sunt virtutes in corpore nostro: animalis vitalis et naturalis*.<sup>48</sup> The physician Agnellus of Ravenna (fl. 550–700) in his lectures on Galen's *On Sects*, also posits the identical three virtues (*virtutes autem sunt tres: animalis, vitalis et naturalis*).<sup>49</sup> John's Latin version nowhere mentions the spirits, and it has been stated that the reason for this omission is that the three spirits 'are subsumed under 'virtutes', and do not require to be singled out a second time'.<sup>50</sup> However, in the extant Greek commentary on the *Aphorisms* of Hippocrates by Stephanus (fl. late sixth–early seventh century), 'perhaps the last representative'<sup>51</sup> of the Alexandrian school, two

<sup>45</sup> Savage-Smith, "Galen's Lost Ophthalmology" 128. On this synopsis see Garofalo I, "Una Nuova Opera di Galeno: La Synopsis del *De methodo medendi* in Versione Araba", *Studi classici e orientali* 47, 1 (1999) 9–19.

<sup>46</sup> Roueché M., "Did Medical Students Study Philosophy in Alexandria?", *Bulletin of the Institute of Classical Studies* 43 (1999) 153–169.

<sup>47</sup> Westerink L.G., "Philosophy and Medicine in Late Antiquity", *Janus* 51 (1964) 169–177.

<sup>48</sup> Johannes Alexandrinus, *Commentaria in librum De sectis Galeni* IX: 50–51 Pritchett. See also Duffy, *Ioannis Alexandrini* 11–12. The situation is further complicated since neither Pritchett (nor Hankinson, R.J., "Notes on the Text of John of Alexandria", *Classical Quarterly* 40 (1990) 585–591) make clear that there may be a discrepancy between the original of John and the Latin version. It is argued by Nutton V., "John of Alexandria Again: Greek Medical Philosophy in Latin Translation", *Classical Quarterly* 41 (1991) 509–519, that the original John may be recovered in those places where Agnellus of Ravenna (as copyist and/or translator) and "Johannes Latinus" coincided. If correct, the original John contributes nothing to the debate, and it is in the Latinus translation (or via an addition to the Greek manuscript) where the insertion takes place. See also Sluiter I., "Two Problems in Ancient Medical Commentaries", *Classical Quarterly* 44 (1994) 270–275.

<sup>49</sup> Westerink L.G. et alii (eds.), *Agnellus of Ravenna. Lectures on Galen's De Sectis. Arethusa Monographs VIII* (Buffalo: 1981) 26 verso, 26.

<sup>50</sup> Nutton, "John of Alexandria Again" 514.

<sup>51</sup> Stephanus, *Stephani Philosophi In Hippocratis Prognosticum commentaria III*: ed. Duffy J.M. (Berlin: 1983) [CMG XI.1.2] 13.

reasons for a healthy complexion are given: an abundance of 'good blood' due to the correct condition of the liver due to the 'natural faculty' (*phusikê dunamis*); the well-balanced state of the 'vital pneuma' (*zôtikon pneuma*), which is in turn due to the good condition of the 'vital faculties' (*zôtikas dunameis*).<sup>52</sup> It would seem that for Stephanus, 'faculty' and 'pneuma' were regarded as distinct, although related, entities, at least as far as the vital component was concerned. One might perhaps have expected a similar pairing of natural faculty with natural pneuma, but this is not the case. If so, then Hunayn may claim the laurels for placing the three spirits on a firm foundation. But there are problems with this interpretation. For if one turns again to John of Alexandria, but this time to the extant Greek fragments of his commentary on Book VI of Hippocrates' *Epidemics*, the following is stated:

But we should remind the more advanced student of what we have said on numerous occasions, namely that our body is composed of solids, fluids and pneumas (*ek pneumatôn*); that the pneumas are the [psychic (*psuchikôn*)], natural (*phusikôn*) and vital (*zôtikôn*).<sup>53</sup>

Admittedly, the mention of a psychic pneuma (rendered as *animalibus*) is an addition made in the later Latin manuscript tradition.<sup>54</sup> Yet it would be strange indeed if so important an entity as psychic pneuma, strongly endorsed by Galen himself, had been omitted in the Greek original. Be that as it may, one can state, albeit tentatively, that at least the existence of a natural pneuma may be accorded the status of a physiological given by the end of the sixth century. For on the one hand, the Late Alexandrian compilers were in all likelihood aware of Galen's hesitancy in respect of the natural pneuma; but codification and systematisation were part and parcel of their work, and Galen's doubts, could, for the sake of a systemic balance in pneumatic physiology with respect to the three faculties, be overridden without undue difficulty. In other words, Galen's uncertainty regarding the natural pneuma could, by a later explicit acknowledgement,

<sup>52</sup> Stephanus, *Stephani Atheniensis In Hippocratis Aphorismos commentaria* CMG XI.1.3.2 (120,4–10 Westerink). Stephanus does seem to have followed Alexandrian Galenic syllabus (ibidem, 12). It is likely that Stephanus of Athens and Stephanus of Alexandria are one and the same. Wolska-Conus W., "Stéphanos d'Athènes et Stéphanos d'Alexandrie: Essai d'Identification et de Biographie", *Revue des Etudes Byzantines* 47 (1989) 5–89, gives a detailed discussion of this question.

<sup>53</sup> *Ioannis Alexandrini In Hippocratis Epidemiarum librum VI commentarii fragmenta* (102,1–4); tr. Duffy.

<sup>54</sup> Duffy, *Ioannis Alexandrini* 102.

be turned into a systematic asset, and may even have been reckoned a theoretical advance; that is, as a useful way of making Galen's tripartite set of powers or faculties seated in the three major organs dovetail with pneuma's physiological role in each organ. After all, Galen, when all is said and done, did mention natural pneuma. It was a recorded datum in the Galenic Corpus.

Nevertheless, it is without doubt that the existence of natural pneuma received a further and arguably more profound validation in ninth-century Baghdad, where, under the patronage of the 'Abbāsid Caliphate, the great Nestorian Christian physician, translator and commentator, Ḥunayn ibn Ishāq (808–873/77) cemented his place as a key figure in the transmission, codification and amplification of Greek medical knowledge.<sup>55</sup> Ḥunayn's linguistic and interpretative skills were formidable.<sup>56</sup> In his *Risāla* (Epistle or Missive), which records the 129 Galenic works he and his team of translators rendered into Syriac and Arabic, Ḥunayn records the efforts made to obtain a good working copy of *On the Therapeutic Method* after examining an earlier Syriac version. Eventually, Ḥunayn was able to track down a reasonable Greek text:

I had several Greek copies of the last eight treatises. I collated them and authenticated one copy from which – to the best of my ability – I produced a well-investigated and eloquent translation.<sup>57</sup>

<sup>55</sup> On Ḥunayn see the two fundamental studies by Bergsträsser G., *Hunain ibn Ishāk und seine Schule* (Leiden: 1913); idem, *Hunain ibn Ishāk. Über die Syrischen und Arabischen Galen-Übersetzungen*, Abhandlungen für die Kunde des Morgenlandes XVII, 2 (Leipzig: 1925). A new study by Lamoreaux is forthcoming in the *Middle Eastern Texts Initiative* series. See also Anawati G.C., "Ḥunayn ibn Ishāq", in Gillespie C.C., *Dictionary of Scientific Biography* (New York: 1981), vol. 15, suppl. 1, 230–234; Strohmaier G., "Galen in Arabic: Prospects and Projects", in Nutton V. (ed.), *Galen. Problems and Prospects* (London: 1981) 187–196. Strohmaier G., "The Greek Heritage in Islam", in Boys-Stones G. – Graziosi B. – Vasunia P. (eds.), *The Oxford Handbook of Hellenic Studies* (Oxford: 2009) 140–149, gives a survey of the Greek heritage in Islam. On the medical background see Savage-Smith E., "Medicine", in Rashed R. (ed.), *Encyclopedia of the History of Arabic Science* (London: 1996) 903–962; Jacquart D., "The Influence of Arabic Medicine in the Medieval West", in Rashed R. (ed.), *Encyclopedia of the History of Arabic Science* (London: 1996) 963–984; Pormann P.E. – Savage-Smith E., *Medieval Islamic Medicine* (Edinburgh: 2007).

<sup>56</sup> 'Ḥunayn apparaît comme un homme exigeant, volontiers critique à l'égard de ses prédécesseurs, soucieux de disposer d'un texte grec correct, s'appliquant à en rendre les sens avec rigueur et précision'. Micheau, F., "Mécènes et Médecins à Bagdad au III<sup>e</sup>/IX<sup>e</sup> Siècle. Les Commanditaires des Traductions de Galien par Ḥunayn ibn Ishāq", in Jacquart D. (ed.), *Les Voies de la Science Grecque. Études sur la Transmission des Texts de l'Antiquité au Dix-Neuvième Siècle* (Geneva: 1997) 148.

<sup>57</sup> Tr. Iskandar A.Z., "Ḥunayn the Translator", in Gillespie C.C., *Dictionary of Scientific Biography* (New York: 1981), vol. 15, suppl. 1, 236. See also Meyerhof M., "New Light on Hunain ibn Ishāq and his period", *Isis* 8 (1926) 692–693; Degen R., "Galen im Syrischen.

Thanks to the Late Alexandrian physician-commentators, the existence of three functioning pneumata or spirits had been more or less posited, and the notion of three virtues was a given, but it is Ḥunayn who extends the number of natural things the physician should study from six to seven: elements, humours, the faculties, and parts of the body, the temperaments, the functions, *and the spirits*. Ḥunayn, to be sure, did not himself devise the concept of three spirits or *pneumata*, but it would seem that he took upon himself the task of formalising an already nascent tripartite system, aware that he was following in the footsteps of his Alexandrian predecessors. Having spent part of his time studying in Alexandria, Ḥunayn would of course have been familiar not only with Galenic texts, but also with the various ways in which they were taught and organised. Thus, 'Galenism was therefore taught and studied through the prism of late antique Alexandria'.<sup>58</sup> It is through this prism that Ḥunayn's own medical writings were filtered and constructed. Consider *The Book of Questions in Medicine for Students* (or *Scholars*), or more simply, *Medical Questions* (*Masā'il fi al-tibb*).<sup>59</sup> This work, with additions by Ḥunayn's linguistically-gifted nephew Hubaysh, served as an introductory medical textbook or set of summary notes to be learnt by heart.<sup>60</sup> The format of the *Medical Questions* attests to the influence of the late Alexandrian medical tradition and in particular to the redactive methodology embodied in the *Summaria Alexandrinorum*.<sup>61</sup> Ḥunayn's *Medical Questions* is a similar pedagogic work employing the Greek philosophical method of *diairesis*, which was

---

Eine Übersicht über die Syrische Überlieferung der Werke Galens" in Nutton (1981) 131–166, 145. The Arabic translation of *De methodo medendi* is yet to be edited (Peter Pormann, personal communication).

<sup>58</sup> Pormann P.E., "Islamic Medicine Crosspollinated: a Multilingual and Multiconfessional Maze", in Akasoy A. – Montgomery J.E. – Pormann P.E. (eds.), *Islamic Crosspollinations. Interactions in the Medieval Middle East* (Exeter: 2007) 83.

<sup>59</sup> For a list of the versions see the commentary on the Arabic critical edition by G. Moussa in Ghalioungui P., *Questions on Medicine for Scholars by Hunayn Ibn Ishaq* (Cairo: 1980), xxxvi–xxxvii.

<sup>60</sup> See Jacquart D. – Micheau F., *La Médecine Arabe et l'Occident Médiéval* (Paris: 1990) 46.

<sup>61</sup> See Jacquart D. – Palmieri N., "La Tradition Alexandrine des Masa'il fi t-tibb de Hunain ibn Ishaq", in Garzya A. (ed.), *Storia e Ecdotica dei Testi Medici Greci*. Atti del II Convegno Internazionale Parigi 24–26 maggio 1994 (Naples: 1996) 217–218. This method of division of the parts of medicine is well attested in writers such as Agnellus of Ravenna, John of Alexandria and Stephanus of Athens, and formed a vital feature in medical teaching in Late Alexandria. See Duffy J.M., "Byzantine Medicine in the Sixth and Seventh Centuries: Aspects of Teaching and Practice", in Scarborough J. (ed.), *Symposium on Byzantine Medicine*. *Dumbarton Oaks Papers* 38 (1984) 21–27.



utilised by the Late Alexandrian Commentators.<sup>62</sup> It opens by asking into how many parts medicine may be divided (two), and of what those parts consist (theory and practice). And in the first chapter, three forces, the natural, vital, and psychic are listed, together with their kinds and their actions. At the end of the chapter, the following is written in regard to the existence and number of the spirits or pneumata, the seventh of the natural things:

How many are the spirits? Three: the natural spirit, the vital spirit, and the psychic spirit. The natural spirit emanates from the liver, penetrates through the veins into the whole body, and is servant to the natural forces. The vital spirit emanates from the heart, penetrates through the arteries into the whole body, and is servant to the vital forces. The psychic spirit emanates from the brain, penetrates through the nerves into the whole body and is servant to the psychic forces.<sup>63</sup>

Here is articulated in explicit terms a tripartite pneumatology, with the 'forces' being the analogue of the familiar motif of Galen's faculties or powers (*dunameis*) that govern us. Ḥunayn's articulation of a natural pneuma (*rūh tabīṭī*), vital pneuma (*rūh hayawānī*), and psychic pneuma (*rūh nafṣānī*) would become a mainstay of Arabic medical theory.<sup>64</sup>

Ḥunayn's position as a translator, facilitator and above all, interpretive mediator of Galenic works, and especially his specific knowledge of *On the therapeutic method*, together with his cognisance of the various strands of Late Alexandrian medical and philosophical exegesis, were key influences when it came to his own medical writing. The *Questions* in particular would also prove to be a text of enduring influence in the Western mediaeval medical tradition and beyond. For by the early twelfth century a Latin translation of an abridgement of Ḥunayn's *Questions*, albeit packaged under the Greek title of the *Isagoge*, made its appearance in the West.<sup>65</sup> Ḥunayn is not mentioned as its author, being replaced by

<sup>62</sup> Agnellus of Ravenna makes use of this method of division as well, as seen in chapter 5 of his lectures on Galen's *De sectis*.

<sup>63</sup> Ghalioungui, *Questions on Medicine* I, 10, 5.

<sup>64</sup> See Pormann – Savage-Smith, *Medieval Islamic Medicine* 45.

<sup>65</sup> 'With a Hellenised title that disguises its origin, the *Isagoge Iohannitii* constitutes the first translation of an Arabic medical text. By comparison with its model (Ḥunayn ibn Ishāq's *Masā'il fi t-tibb*), the Latin version has many imperfections; it is a kind of anthology, gathering from the *Masā'il* some clumsily cut extracts. The technical vocabulary is also somewhat clumsy, showing on the part of the translator a great hesitation in the rendering of the most basic Galenic notions. This clumsiness is attributable more to the poor quality of the existing Latin vocabulary than to an ignorance of Arabic'. Jacquart D., "The Introduction of Arabic Medicine into the West: The Question of Etiology", in Campbell S. – Hall B. – Klausner D., *Health, Disease and Healing in Medieval Culture* (London: 1992) 188.



one 'Johannitius'.<sup>66</sup> The *Isagoge* was probably the first medical text translated from Arabic, and this translation was composed (1075–1085/90) by a Tunisian Benedictine monk of Monte Cassino, Constantine the African (fl. ca. 1070–1097).<sup>67</sup> The *Isagoge* was one of five key texts of the twelfth-century medical *Canon* (later, *Articella*) of the medical curriculum of the famous, but by no means doctrinally monolithic, 'school' of Salerno.<sup>68</sup> If its influence has been perhaps exaggerated, for after all Salerno did not invent the concept of a medical canon,<sup>69</sup> it is nevertheless safe to say that by Constantine the African's time, it was 'the leading center of medical instruction, theory and literature'<sup>70</sup> in the Latin West. In common with Hunayn's original, Constantine mentions the three forces (*virtutes*) to which the spirits are subservient:

The first force – that is, the 'naturalis' – takes its beginning from the liver, the second, which is the 'zotica', from the heart, and the other, which is from the brain, [is] the 'spiritualis'.<sup>71</sup>

Manuscripts of the twelfth and thirteenth centuries, from which later texts such as the Vulgate derive, lack this sentence describing the seat of the forces, which Constantine's text 'alone of all manuscripts preserves'.<sup>72</sup> Although the section mentioning the number and location of the spirits in

<sup>66</sup> For an excellent discussion of the *Isagoge*'s textual tradition see Jacquart D., "À l'aube de la Renaissance médicale des XI<sup>e</sup>–XII<sup>e</sup> siècles: L' 'Isagoge Johannitii' et son traducteur", *Bibliothèque de l'École des Chartes* 144 (1986) 209–240, especially 231–237. See also Gracia Guillén D. – Alvarez Vizcaíno A.J., "El Galenismo Medieval a Traves De La 'Isagoge Iohannitii'", in López Férez J.A. (ed.), *Galeno. Obra, Pensamiento, e Influencia* (Madrid: 1993) 253–272.

<sup>67</sup> See Newton F., "Constantine the African and Monte Cassino: New Elements and the Text of the *Isagoge*", in Burnett C. – Jacquart D. (eds.), *Constantine the African and Ali Ibn Al-Abbas Al-Maguis. The Pantegni and Related Texts* (Leiden: 1994) 16–47, from whose account the above has been drawn.

<sup>68</sup> On the role of the 'School of Salerno' in Western medicine, the fundamental study is that of Kristeller P.O., "The School of Salerno: Its Development and Contribution to the History of Learning", *Bulletin of the History of Medicine* 17 (1945) 138–194. For a critical re-evaluation of the evidence, see Jacquart D. – Bagliani A.P. (eds.), *La scuola medica Salernitana gli autori e i testi* (Florence: 2007).

<sup>69</sup> 'The idea of an introductory canon in medicine did not originate at Salerno and need not have been re-invented there'. Jordan M.D., "Medicine as Science in the Early Commentaries on 'Johannitius'", *Traditio*, 43 (1987) 129.

<sup>70</sup> Kristeller P.O., *Studies in Renaissance Thought and Letters III* (Rome: 1993) 435.

<sup>71</sup> Newton, "Constantine the African" 34. See also the discussion in Jacquart D., "À l'aube de la Renaissance médicale" 217–218; Jacquart D., "Les antécédents gréco-latins de l'Isagoge Iohannitii", in Vázquez Buján M.E. (ed.), *Tradición e innovación de la Medicina Latina de la Antigüedad y de la alta Edad Media. Cursos e Congresos da Universidade de Santiago de Compostela* 83 (Santiago de Compostela: 1994) 84–86.

<sup>72</sup> Newton, "Constantine the African" 34. And see the important comparative table at 41–42.

liver, heart and brain is missing in Constantine's translation,<sup>73</sup> he renders the subsequent destination of each of the three spirits as follows:

Also, the first of these moves into the veins which do not have pulse (*non habent pulsum*) and the whole body, the second into the arteries (*arterias*) and the third into the nerves (*nervos*), which seventh of the natural things [meaning spirit] obeys the fifth of the natural things [meaning force], that is, it [meaning force] is recognised or known in [the form of] spirit.<sup>74</sup>

This may be compared with the relevant section of Ḥunayn's *Questions*, cited earlier:

How many are the spirits? Three: the natural spirit, the vital spirit, and the psychic spirit. The natural spirit emanates from the liver, penetrates through the veins into the whole body, and is servant to the natural forces. The vital spirit emanates from the heart, penetrates through the arteries into the whole body, and is servant to the vital forces. The psychic spirit emanates from the brain, penetrates through the nerves into the whole body and is servant to the psychic forces.

Yet, while Ḥunayn had carefully bracketed each of the particular spirits with its corresponding controlling force, in keeping with what he regarded as Galenic tradition, this is not the case in the *Isagoge*; rather, the notion of the forces has here been redacted to a general statement at the end of the section concerning the spirits. Although it is stated that the spirits are subservient to (*paret*) the forces, such a statement also carries the implication that the role of the forces is now subject to interpretive fortune; or rather, the scope and status of *pneuma* could be allowed to increase. For example, later manuscripts (the Paris and the Vulgate) both carry the location of each individual spirit, but, critically, they both also lack the section on the *virtutes*, which Constantine had translated.<sup>75</sup>

The *Isagoge*, of course, is not the whole story of Galenism's tripartite pneumatology, even though, as has been argued, it formed, in Salerno at any rate, 'the most important single work of the canon for theoretical medicine'.<sup>76</sup> Constantine's other significant contribution to medicine, the so-called *Pantegni*, must also be considered. This work is a translation of the 'Complete Exposition of the Medical Art' by the tenth-century

<sup>73</sup> On the varying textual omissions and discrepancies see Newton, "Constantine the African" 34–35.

<sup>74</sup> Translation and emendation by Newton, "Constantine the African" 34–35.

<sup>75</sup> See the table in Newton, "Constantine the African" 42.

<sup>76</sup> Jordan M.D., "The Construction of a Philosophical Medicine: Exegesis and Argument in Salernitan Teaching on the Soul", *Osiris* 6 (1990) 43.

physician and encyclopaedist 'Ali ibn al-'Abbas al-Majūsī (Haly Abas). The *Pantegni* would come to rival Avicenna's *Canon* in influence.<sup>77</sup> In the chapter on the spirits (*Theorica*, IV,19,2–6), the three spirits are mentioned, and their relationship to the faculties is unambiguously asserted:

Omnis ergo spiritus tripartitus. Est enim naturalis, est vitalis vel spiritualis, est et animalis. Naturalis nascitur in epate, unde per venas ad totius corporis vadit membra, virtutem naturalem regit et augmentat, actiones eius custodiens. Hic igitur ex perfecti sanguinis fummo nascitur, qui in epate mundificatus et digestus ex omnibus humoribus clare depuratur. Spiritualis qui et vitalis spiritus dicitur in corde nascitur, vadens per arterias ad totius corporis membra, spiritualem virtutem seu vitalem augmentans atque regens actionesque eius custodiens. Spiritus animalis in cerebri nascitur ventriculis, per nervos tendens ad membra totius corporis, unde animalis virtus regitur et augmentatur actionesque eius custodiuntur.<sup>78</sup>

The potentiality of pneuma's amplified role is directly addressed, for the relationship between *virtutes* and *spiritus* has now been reversed. Here, the virtues are subservient to the spirits, who now rule (*regunt*) them.<sup>79</sup> Moreover, the physiology of the natural spirit in particular is also augmented, being said to 'arise from the fumes of perfect blood' (*ex perfecti sanguinis fumo nascitur*).<sup>80</sup> Constantine's translations indicate he was well aware of pneuma's role in physiology.<sup>81</sup> These textual interpretive renderings would form the template for subsequent interpretations of Galen's pneumatology throughout the Medieval and Renaissance periods; in particular, the importance of the *Isagoge* itself on theoretical medicine, to say nothing of its emphatic codification of a tripartite pneumatology, cannot be exaggerated.<sup>82</sup> Moreover, the translations and editions of the *Isagoge* helped

<sup>77</sup> See Jacquart D., "Medical Scholasticism", in Grmek M.D. (ed.), *Western Medical Thought from Antiquity to the Middle Ages* (Cambridge, Mass.: 1998) 204–205.

<sup>78</sup> Cited in Burnett C., "The Chapter on the Spirits in the *Pantegni* of Constantine the African", in Burnett C. – Jacquart D. (eds.), *Constantine the African and Ali Ibn Al-Abbas Al-Maguis. The Pantegni and Related Texts* (Leiden: 1994) 115.

<sup>79</sup> See Newton, "Constantine the African" 35 n. 73.

<sup>80</sup> See Burnett, "The Chapter on the Spirits" 108–110 for parallels with the Pseudo-Galenic *De spermate*.

<sup>81</sup> Mention should be made in passing of Constantine's translation of Isaac Israeli's *De febris*, which also describes a tripartite pneumatology. Cf. Burnett, "The Chapter on the Spirits" 104.

<sup>82</sup> The *Isagoge's* discussion (chs. 9–13) of the functions of the soul, 'is of obvious importance to medical theory but also to philosophical and theological anthropology. The topics raised here figure ancient, patristic, and medieval works of very different genres, including basic accounts of biology, moralising depictions of the passions, analyses of sensation, and hexaemeral commentaries on Genesis. They offer a particularly clear case for studying

usher in a decisive shift in the Latin West towards 'learned medicine'.<sup>83</sup> The *Isagoge*, together with the *Pantegni* and their later redacted variants, would find ready acceptance with student, commentator and the learned public alike.<sup>84</sup> Partly based on Galen's own notions of powers or faculties that govern us, these texts would help fix the notion of placing the three faculties into a fully-defined relationship to the relevant pneuma or spirit. They would also afford scope for the physiological role of pneuma, particularly its natural form, to increase, and for pneuma's latent power to be realised.

### Conclusion

To Galen's later commentators, although not restricted to them, *schema-tisation* was a feature that perhaps above all else, readily appealed. Galen therefore, or at any rate his successive transfigurations, could be seen (or rather was made) to possess a doctrine of three pneumata or spirits, which existed in physiological and psychological symmetry with the three faculties of the soul.<sup>85</sup> Soul and body thus possessed a set of interfaces whose physiological, psychological and theological interrelationships would much exercise the history of medicine in the West until at least the Early Modern period. The doctrine of spirits allowed great interpretive scope. For example, in the hands of Jean Fernel (?1497–1558) of the medical school of Paris, Book IV of *Physiologia* (1542) gives Galen's pneumatic

---

adjustments or dislocations in the hierarchy of learning'. Jordan, "The Construction of a Philosophical Medicine" 43–44.

<sup>83</sup> Riddle J.M., "Theory and Practice in Medieval Medicine", *Viator* 5 (1974) 175 and n. 78. As Jacquart and Micheau, *La Médecine Arabe* 102 note, 'L'Isagoge constitue, en quelque sorte, la colonne vertébrale de la science médicale médiévale: brièvement lui permet d'être sue par cœur par les étudiants; son laconisme invita à chercher une information complémentaire et à lui consacrer d'amples commentaries'.

<sup>84</sup> Constantine the African, in particular, keyed the *Pantegni* to appeal also to a more general educated readership. See Jacquart, "Medical Scholasticism" 236. Dante constituted just such an erudite layman and may be cited as testifying to the spread of Latin medical learning throughout the Italian peninsula. In *Vita Nuova*, section II, he describes, in psycho-physiological terms, the effect of meeting Beatrice for the first time by way of the reaction of natural, vital and animal spirits to such a stimulus.

<sup>85</sup> Of course, not everyone accepted a tripartite scheme. Giambattista da Monte, for one, echoed Galen's doubts on the inclusion of natural pneuma. See Siraisi N., *Avicenna in Renaissance Italy* (Princeton: 1987) 338.

physiology a cosmological origin.<sup>86</sup> Crafted within the wider background of Renaissance Platonism, this conceptualisation of pneuma also reflects the durability of the Stoic conceptualisation of pneuma or *spiritus* as an aetherial element.<sup>87</sup> It also acknowledges the strength of the pneumatic concept as opposed to that of the corresponding faculties. It would be left to William Harvey (1578–1657), a vigorous opponent of Fernel's doctrine of the spirits, a part of whose refutation was quoted at the beginning of this chapter, to conceptualise a new understanding of the heart and the vessels, and the crucial role of the 'excellent endowments' of the blood. This, whilst not entirely eliminating the doctrine of the spirits, henceforward made them surplus to absolute physiological requirements.<sup>88</sup> Not that Harvey entirely abandoned the concept of *spiritus*; rather it could now be better employed as a signifier of 'a visible quality, or modality, of matter: the liveliness or vitality of the blood, which imparts these same qualities to the blood as a whole'.<sup>89</sup> Moreover, neither Fernel nor Harvey abandoned the concept of physiology as fundamentally a discourse, a meditative narration on the body of nature. For Fernel, as for Harvey, 'physiology is a thinking discipline based on the active investigative discipline of anatomy'.<sup>90</sup> This is 'physiology' as Galen would have understood it, with pneuma forming the conceptual functional theorem dependent upon anatomical demonstration.

At one level, Galen's citation of natural pneuma is no more than an acknowledgment that, in his period, some physicians and philosophers accepted its existence either as a general concept or specialised physiological principle, and that a certain amount of unspecified pneuma (*pneuma simpliciter*, as it were), was necessary in Galen's system (and in

---

<sup>86</sup> Siraisi N., *The Clock and the Mirror. Girolamo Cardano and Renaissance Medicine* (Princeton: 1997) 159 'Essentially, Fernel maintained that in addition to the animal, vital, and natural spirits of standard Galenic medical teaching, celestial *spiritus* of divine origin flowed down from the heavens into the very substance of terrestrial things and were the bearers of form. Within the body these special divine *spiritus* were the carriers of innate heat and the source of all vital function'.

<sup>87</sup> And see Bono, *The Word of God* 97–103. On the influence of Stoicism in medicine in the Early Modern period, see Barker P., "Stoic Contributions to Early Modern Science", in Osler M.J. (ed.), *Atoms, Pneuma, and Tranquillity. Epicurean and Stoic Themes in European Thought* (Cambridge: 1991) 135–154.

<sup>88</sup> In this, Harvey was opposed by Francis Glisson (1598–1677), Regius Professor of Physic at Cambridge, who 'continued to give a major role to spirits, which were [...] a fundamental part of his natural philosophy'. French R., *William Harvey's Natural Philosophy* (Cambridge: 1994) 304.

<sup>89</sup> Bono, *The Word of God* 107.

<sup>90</sup> Cunningham, "The Pen and the Sword" 648.

others) as an aid in explaining certain pathological phenomena – syncope, for example, as has been discussed above. For, subsumed in a wider process or discourse, pneuma need not be specialised. But for the heart and the arteries, Galen (and, again, others) saw that a more specialised form of pneuma was required. Even that, however, was but a precursor to the most important pneuma of all – psychic pneuma, the medium by which for Galen the rational soul operates. By contrast, natural pneuma remained for him a physiological (and psychological) non-requirement. As has been shown, for Galen to insist on such a connection between the faculties of soul on the one hand, and the pneumata on the other is to run the risk of granting a greater credence to natural pneuma (and in raising expectations as to what its function might be) than Galen is willing to do. For of course, while it is one thing to allow that natural pneuma is perhaps to be found in the liver and veins, it is another to delineate its function. Yet from Galen's singular mention of natural pneuma, an entire medical philosophy was created, highlights of which have been sketched in the course of this chapter. Galen's pneumatic physiology, presented in its own terms, is fascinating not only in what it reveals of the efforts of a highly-educated medical scientist of the second century AD to determine how the body functions in a descriptive sense, but for the ways in which this particular legacy was subsequently interpreted under Galenism. In such readings, inconsistencies and errors based on the sheer magnitude of the project concerned were inevitable. But a tripartite systematisation of pneuma seemed the appropriate foil to the corresponding triune faculties, and an eloquent testimony to the 'demands of symmetry'<sup>91</sup> implicit in such a scheme. Neither Galen nor later commentators should be censured for using pneuma to elucidate concepts in functional anatomy. Nor should they be castigated for its immensely long explanatory lifespan. After all, pneuma itself was a component of a physiology that was itself regarded as a branch of natural philosophy, and which, until the early nineteenth century, 'reached the truth by philosophising'.<sup>92</sup> If nothing else, Galen's pneumatology, considered on its own or through later reification, serves as a salutary reminder of the abiding potency of the analogical model in non-experimental physiology.

---

<sup>91</sup> Siraisi N., *Medieval and Early Renaissance Medicine* (Chicago-London: 1990) 108.

<sup>92</sup> Cunningham, "The Pen and the Sword" 648.

*Selective bibliography*

- ADAMSON P. – BALTUSSEN H. – STONE M.W.F. (eds.), *Philosophy, Science and Exegesis in Greek, Arabic and Latin Commentaries*, *Bulletin of the Institute of Classical Studies*. Supplement 83 (London: 2004).
- AKASOY A. – MONTGOMERY J.E. – PORMANN P.E. (eds.), *Islamic Crosspollinations. Interactions in the Medieval Middle East* (Exeter: 2007).
- ANAWATI G.C., "Hunayn ibn Ishâq", in Gillespie C.C., *Dictionary of Scientific Biography*, Volume 15, Supplement 1 (New York: 1981) 230–234.
- BARKER P., "Stoic Contributions to Early Modern Science", in Osler M.J. (ed.), *Atoms, Pneuma, and Tranquillity. Epicurean and Stoic Themes in European Thought* (Cambridge: 1991) 135–154.
- BERGSTRÄSSER G., *Hunain ibn Ishâq. Über die syrischen und arabischen Galen-Übersetzungen*, *Abhandlungen für die Kunde des Morgenlandes XVII*, 2 (Leipzig: 1925).
- , *Hunain ibn Ishâq und seine Schule* (Leiden: 1913).
- BONO J.J., "Medical Spirits and the Medieval Language of Life", *Traditio* XL (1984) 91–130.
- , *The Word of God and the Languages of Man*. Volume 1 (Madison: 1995).
- BOUDON-MILLOT V. – PIETROBELLI A., "Galien ressuscité: Édition princeps du texte Grec du *De propriis placitis*", *Revue des Études Grecques* 118 (2005) 168–213.
- BOYS-STONES G. – GRAZIOSI B. – VASUNIA, P. (eds.), *The Oxford Handbook of Hellenic Studies* (Oxford: 2009).
- BURNETT C., "The Chapter on the Spirits in the *Pantegni* of Constantine the African", in Burnett C. – Jacquart D. (eds.), *Constantine the African and Ali Ibn Al-Abbas Al-Maguis. The Pantegni and Related Texts* (Leiden: 1994) 99–120.
- BURNETT C. – JACQUART D. (eds.), *Constantine the African and Ali Ibn Al-Abbas Al-Maguis. The Pantegni and Related Texts* (Leiden: 1994).
- BURTON ROBERT, *The Anatomy of Melancholy* (Oxford: 1638<sup>5</sup>).
- CAMPBELL S. – HALL B. – KLAUSNER D., *Health, Disease and Healing in Medieval Culture* (London: 1992).
- CUNNINGHAM A., "The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy before 1800 I: Old Physiology – The Pen", *Studies in History and Philosophy of Science Part C. Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002) 631–665.
- DEBRU A., "Galen on the Unclear Movements", in Nutton V. (ed.), *The Unknown Galen* (London: 2002) 79–85.
- DEGEN R., "Galen im Syrischen: Eine Übersicht über die Syrische Überlieferung der Werke Galens" in Nutton V. (ed.), *Galen. Problems and Prospects* (London: 1981) 131–166.
- DICKSON K., *Stephanus the Philosopher and Physician. Commentary on Galen's Therapeutics to Glaucôn* (Leiden: 1998).
- DUFFY J.M., "Byzantine Medicine in the Sixth and Seventh Centuries: Aspects of Teaching and Practice", in Scarborough J. (ed.), *Symposium on Byzantine Medicine. Dumbarton Oaks Papers* 38 (1984) 21–27.
- DURLING R.J., "The Innate Heat in Galen", *Medizinhistorisches Journal* 23 (1988) 210–212.
- FRENCH R., *William Harvey's Natural Philosophy* (Cambridge: 1994).
- FURLEY D.J. – WILKIE, J.S., *Galen on Respiration and the Arteries* (Princeton: 1984).
- GALEN: *De placitis Hippocratis et Platonis*: ed./tr. de Lacy, P. (1980), *On the Doctrines of Hippocrates and Plato, Edition, Translation and Commentary. Second Part. Books VI–IX, CMG V.4.1.2*, Berlin.
- , *De propriis placitis*: ed./tr. Nutton V., CMG V.3.2 (Berlin: 1999).
- , *De usu partium*: ed. Helmreich G. (1907, 1909), *De Usu Partium Libri XVII*, 2 vols., Leipzig.
- , *De usu partium*: ed. May M.T. (1968), *On the Usefulness of the Parts of the Body*, Cornell.



- , *Opera omnia*: ed. Kühn C.G., 20 vols. (Leipzig: 1821–1833).
- GAROFALO I., “Una Nuova Opera di Galeno: La Synopsis del *De Methodo Medendi* in Versione Araba”, *Studi Classici e Orientali* 47 (1999) 9–19.
- , “I Sommari degli Alessandrini” in Garofalo I. – Roselli A. (eds.), *Galenismo e Medicina Tardoantica Fonti Greche, Latine e Arabe*, Annali dell'Istituto Universitario Orientale de Napoli, Quaderni 7 (Naples: 2003) 203–231.
- GAROFALO I. – ROSELLI A. (eds.), *Galenismo e Medicina Tardoantica Fonti Greche, Latine e Arabe*, Annali dell'Istituto Universitario Orientale de Napoli, Quaderni 7 (Naples: 2003).
- GARZYA A. (ed.), *Storia e Ecdotica dei Testi Medici Greci*, Atti del II Convegno Internazionale Parigi 24–26 maggio 1994 (Naples: 1996).
- GHALIOUNGUI P., *Questions on Medicine for Scholars by Hunayn Ibn Ishaq* (Cairo: 1980).
- GILLESPIE C.C., *Dictionary of Scientific Biography*, Volume 15, Supplement 1 (New York: 1981).
- GRACIA GUILLÉN D. – ALVAREZ VIZCAÍNO A.J., “El Galenismo Medieval a Traves De La ‘Isagoge Iohannitii’”, in López Férez J.A. (ed.), *Galeno. Obra, Pensamiento, e Influencia* (Madrid: 1993) 253–272.
- GRENSEMANN H., *Die Hippokratische Schrift Über die Heilige Krankheit*, *Ars Medica* II, 1 (Berlin: 1968).
- GRMEK M.D. (ed.), *Western Medical Thought from Antiquity to the Middle Ages* (Cambridge, Mass.: 1998).
- GRÜNBART M. – KISLINGER E. – MUTHESIUS A. – STATHAKOPOULOS D.CH. (eds.), *Material Culture and Well-Being in Byzantium (400–1453)* (Vienna: 2007).
- HANKINSON R.J., “Notes on the Text of John of Alexandria”, *Classical Quarterly* 40 (1990) 585–591.
- , “Body and Soul in Galen”, in King R.A.H. (ed.), *Common to Body and Soul. Philosophical Approaches to Explaining Living Behaviour* (Berlin: 2006) 232–258.
- , (ed.), *The Cambridge Companion to Galen* (Cambridge: 2008).
- HARRIS C.R.S., *The Heart and the Vascular System in Ancient Greek Medicine. From Alcmaeon to Galen* (Oxford: 1973).
- HARRIS W.V. – RUFFINI G. (eds.), *Ancient Alexandria between Egypt and Greece*, Columbia Studies in the Classical Tradition XXVI (Leiden: 2004).
- HIPPOCRATES: ed. Littré E. (1839–1861), *Œuvres Complètes d'Hippocrate*, Paris.
- ISKANDAR A.Z., “An Attempted Reconstruction of the Late Alexandrian Medical Curriculum”, *Medical History* 20 (1976) 235–258.
- , “Hunayn the Translator”, in Gillispie C.C., *Dictionary of Scientific Biography*, Volume 15, Supplement 1 (New York: 1981) 234–249.
- JACQUART D., “À l'aube de la Renaissance médicale des XI<sup>e</sup>–XII<sup>e</sup> siècles: L' ‘Isagoge Iohannitii’ et son traducteur”, *Bibliothèque de l'École des chartes*, 144 (1986) 209–240.
- , “Les antecedents Gréco-Latins de l'Isagoge Iohannitii”, in Vázquez Buján M.E. (ed.), *Tradición e innovación de la Medicina Latina de la Antigüedad y de la alta Edad Media*, Cursos e Congresos da Universidade de Santiago de Compostela 83 (Santiago de Compostela: 1994) 77–86.
- , (ed.), *Les Voies de la Science Grecque Études sur la Transmission des Texts de L'Antiquité au Dix-Neuvième Siècle* (Geneva: 1997).
- , “Medical Scholasticism”, in Grmek M.D. (ed.), *Western Medical Thought from Antiquity to the Middle Ages* (Cambridge, Mass.: 1998) 197–240.
- , “The Influence of Arabic Medicine in the Medieval West”, in Rashed R. (ed.), *Encyclopedia of the History of Arabic Science* (London: 1996) 963–984.
- , “The Introduction of Arabic Medicine into the West: The Question of Etiology”, in Campbell S. – Hall B. – Klausner D., *Health, Disease and Healing in Medieval Culture* (London: 1992) 186–195.
- JACQUART D. – BAGLIANI A.P. (eds.), *La scuola medica Salernitana gli autori e i testi* (Florence: 2007).
- JACQUART D. – MICHEAU F., *La médecine Arabe et L'Occident médiéval* (Paris: 1990).

- JACQUART D. – PALMIERI N., "La Tradition Alexandrine des Masa'il fi t-tibb de Hunain ibn Ishâq", in Garzya A. (ed.), *Storia e ecdotica dei testi medici greci Atti del II Convegno Internazionale Parigi 24–26 maggio 1994* (Naples: 1996) 217–236.
- JOHN OF ALEXANDRIA, *Joannis Alexandrini In Hippocratis epidemiarum librum VI commentarii fragmenta*: ed./tr. Duffy J.M., CMG XI.1.4 (Berlin: 1997).
- JOHNSTONE P. (ed.), *Studies in Medieval Arabic Medicine. Theory and Practice* (London: 1984).
- JORDAN M.D., "Medicine as Science in the Early Commentaries on 'Johannitus'", *Traditio* 43 (1987) 121–145.
- , "The Construction of a Philosophical Medicine: Exegesis and Argument in Salernitan Teaching on the Soul", *Osiris* 6 (1990) 42–61.
- KING R.A.H. (ed.), *Common to Body and Soul. Philosophical Approaches to Explaining Living Behaviour* (Berlin: 2006).
- KIRK G.S. – RAVEN J.E. – SCHOFIELD M., *The Presocratic Philosophers* (Cambridge: 1991<sup>2</sup>).
- KOLLESCH J., *Untersuchungen zu den Pseudogalenischen Definitiones Medicae* (Berlin: 1973).
- KRISTELLER P.O., "Philosophy and Medicine in Medieval and Renaissance Italy", in Spicker S.F. (ed.), *Philosophy and Medicine* 7 (Dordrecht-Boston: 1978) 29–40 [Reprinted in Kristeller, *Studies in Renaissance Thought and Letters III* (Rome: 1993) 431–442].
- , *Studies in Renaissance Thought and Letters III* (Rome: 1993).
- , "The School of Salerno: Its Development and Contribution to the History of Learning", *Bulletin of the History of Medicine* 17 (1945) 138–194 [Reprinted in idem, *Studies in Renaissance Thought and Letters* (Rome: 1956) 495–551].
- LACY, P. DE, "The Third Part of the Soul", in Manuli P. – Vegetti M. (eds.), *Le opere psicologiche di Galeno* (Naples: 1988) 43–63.
- LIEBER E., "Galen in Hebrew: The Transmission of Galen's Works in the Mediaeval Islamic World", in Nutton V. (ed.), *Galen. Problems and Prospects* (London: 1981) 167–186.
- LLOYD G.E.R., "Scholarship, Authority and Argument in Galen's *Quod Animi Mores*", in Manuli P. – Vegetti M. (eds.), *Le opere psicologiche di Galeno* (Naples: 1988) 11–42.
- LÓPEZ FÉREZ J.A., (ed.), *Galeno. Obra, pensamiento, e influencia* (Madrid: 1993).
- MANULI P., "La Passione nel *De Placitis Hippocratis et Platonis*", in Manuli P. – Vegetti M. (eds.), *Le opere psicologiche di Galeno* (Naples: 1988) 185–214.
- MANULI P. – VEGETTI M., *Cuore, sangue e cervello. Biologica e antropologica nel pensiero antico* (Milan: 1977).
- , (eds.), *Le opere psicologiche di Galeno: atti del terzo colloquio galenico internazionale, Pavia, 10–12 settembre 1986* (Naples: 1988).
- MEYERHOF M., "New Light on Hunain ibn Ishâq and his Period", *Isis* 8 (1926) 685–724 [Reprinted in Johnstone P. (ed.), *Studies in Medieval Arabic Medicine. Theory and Practice*, Study I (London: 1984)].
- MICHEAU, F., "Mécènes et Médecins à Bagdad au III<sup>e</sup>/IX<sup>e</sup> Siècle: Les Commanditaires des Traductions de Galien par Hunayn ibn Ishâq", in Jacquart D. (ed.), *Les voies de la science grecque. Études sur la transmission des textes de l'antiquité au dix-neuvième siècle* (Geneva: 1997) 147–179.
- NEWTON F., "Constantine the African and Monte Cassino: New Elements and the Text of the *Isagoge*", in Burnett C. – Jacquart D. (eds.), *Constantine the African and Ali Ibn Al-Abbas Al-Maguis. The Pantegni and Related Texts* (Leiden: 1994) 16–47.
- NUTTON V., "Ammianus and Alexandria", *Clio Medica* 7 (1972) 165–176.
- , *Ancient Medicine* (London-New York: 2004).
- , *Galen. On Problematic Movements* (Cambridge: 2011).
- , (ed.), *Galen. Problems and Prospects* (London: 1981).
- , "Galen in Byzantium", in Grünbart M. – Kislinger E. – Muthesius A. – Stathakopoulos D.Ch. (eds.), *Material Culture and Well-Being in Byzantium (400–1453)* (Vienna: 2007) 171–176.
- , "John of Alexandria Again: Greek Medical Philosophy in Latin Translation", *Classical Quarterly* 41 (1991) 509–519.

- , (ed.), *The Unknown Galen* (London: 2002).
- ONIAN R.B., *The Origins of European Thought about the Body, the Mind, the Soul, the World, Time and Fate* (Cambridge: 1951).
- OSLER M.J. (ed.), *Atoms, Pneuma, and Tranquillity. Epicurean and Stoic Themes in European Thought* (Cambridge: 1991).
- PORMANN P.E., "Islamic Medicine Crosspollinated: A Multilingual and Multiconfessional Maze", in Akasoy A. – Montgomery J.E. – Pormann P.E. (eds.), *Islamic Crosspollinations. Interactions in the Medieval Middle East* (Exeter: 2007) 76–93.
- , "Medical Education in Late Antiquity: From Alexandria to Montpellier", in Horstmannshoff M. (ed.), *Hippocrates and Medical Education. Selected Papers Presented at the XIIth International Hippocrates Colloquium. Universiteit Leiden, 24–26 August 2005. Studies in Ancient Medicine 35* (Leiden: 2011) 419–442.
- , "The Alexandrian Summary (Jawâmi') of Galen's *On the Sects for Beginners: Commentary or Abridgement*", in Adamson P. – Baltussen H. – Stone M.W.F. (eds.), *Philosophy, Science and Exegesis in Greek, Arabic and Latin Commentaries, Bulletin of the Institute of Classical Studies Supplement 83* (London: 2004), vol. 2, 11–33.
- PORMANN P.E. – SAVAGE-SMITH E., *Medieval Islamic Medicine* (Edinburgh: 2007).
- PRITCHET C.D. (ed.), *Iohannis Alexandrini commentaria in librum De sectis Galeni* (Leiden: 1982).
- RASHED, R. (ed.), *Encyclopedia of the History of Arabic Science* (London: 1996).
- RIDDLE J.M., "Theory and Practice in Medieval Medicine", *Viator* 5 (1974) 157–184.
- ROCCA J., *Galen on the Brain. Anatomical Knowledge and Physiological Speculation in the Second Century A.D.* (Leiden: 2003).
- , *Genesis, Elaboration and Differentiation in Galen's Pneumatologies* (Sydney: 1995) (PhD thesis).
- ROUECHÉ M., "Did Medical Students Study Philosophy in Alexandria?", *Bulletin of the Institute of Classical Studies* 43 (1999) 153–169.
- SAVAGE-SMITH E. "Medicine", in Rashed R. (ed.), *Encyclopedia of the History of Arabic Science* (London: 1996) 903–962.
- , "Galen's Lost Ophthalmology and the *Summaria Alexandrinorum*", in Nutton V. (ed.), *The Unknown Galen* (London: 2002) 121–138.
- SCARBOROUGH J. (ed.), *Symposium on Byzantine Medicine, Dumbarton Oaks Papers 38* (Washington DC: 1984).
- SINGER C. – UNDERWOOD E.A., *A Short History of Medicine* (Oxford: 1962).
- SIRAI SI N., *Avicenna in Renaissance Italy* (Princeton: 1987).
- , *Medieval and Early Renaissance Medicine* (Chicago-London: 1990).
- , *The Clock and the Mirror. Girolamo Cardano and Renaissance Medicine* (Princeton: 1997).
- SLUITER I., "Two Problems in Ancient Medical Commentaries", *Classical Quarterly* 44 (1994) 270–275.
- SPICKER S.F. (ed.), *Philosophy and Medicine* 7 (Dordrecht-Boston: 1978).
- STADEN H. VON, *Herophilus. The Art of Medicine in Early Alexandria* (Cambridge: 1989).
- , "Galen's Alexandria", in Harris W.V. – Ruffini G. (eds.), *Ancient Alexandria between Egypt and Greece, Columbia Studies in the Classical Tradition XXVI* (Leiden: 2004) 179–215.
- STEPHANUS, *Stephani Philosophi In Hippocratis Prognosticum commentaria III*: ed. Duffy J.M., CMG XI.1.2 (Berlin: 1983).
- , *Stephani Atheniensis In Hippocratis Aphorismos commentaria III–IV*: ed. Westerink L.G., CMG XI.1.3.2 (Berlin: 1992).
- STROHMAIER, G., "Galen in Arabic: Prospects and Projects", in Nutton V. (ed.), *Galen. Problems and Prospects* (London: 1981) 187–196.
- , "The Greek Heritage in Islam", in Boys-Stones G. – Graziosi B. – Vasunia, P. (eds.), *The Oxford Handbook of Hellenic Studies* (Oxford: 2009) 140–149.
- TEMKIN O., "Byzantine Medicine: Tradition and Empiricism", *Dumbarton Oaks Papers* 16 (1962) 97–115 [repr. in *The Double Face of Janus* (Baltimore: 1977) 202–222].

- , *Galenism. Rise and Decline of a Medical Philosophy* (Cornell: 1973).
- , "Geschichte des Hippokratismus im Ausgehenden Alterum", *Kyklos. Jahrbuch für Geschichte und Philosophie der Medizin* 4 (1932) 1–80.
- , "On Galen's Pneumatology", *Gesnerus* 8 (1951) 180–189 [Reprinted in idem, *The Double Face of Janus* (Baltimore: 1977) 154–161].
- VÁZQUEZ BUJÁN M.E. (ed.), *Tradición e innovación de la medicina latina de la antigüedad y de la Alta Edad Media*, Cursos e Congresos da Universidade de Santiago de Compostela 83 (Santiago de Compostela: 1994).
- VERBEKE G., *L'Évolution de la doctrine du pneuma du stoïcisme à S. Augustin: étude philosophique* (Paris: 1945).
- WELLMANN M., *Die Pneumatische Schule. Bis auf Archigenes* (Berlin: 1895).
- WESTERINK L.G., et alii (eds.), *Agnellus of Ravenna. Lectures on Galen's De Sectis. Arethusa Monographs VIII* (Buffalo: 1981).
- , "Philosophy and Medicine in Late Antiquity", *Janus* 51 (1964) 169–177 [Repr. in idem, *Texts and Studies in Neoplatonism and Byzantine Literature* (Amsterdam: 1980) 83–91].
- WILSON N.G., *Scholars of Byzantium* (London: 1996).
- WOLSKA-CONUS W., "Stéphanos d'Athènes et Stéphanos d'Alexandrie: Essai d'identification et de biographie", *Revue des Etudes Byzantines* 47 (1989) 5–89.



METABOLISMS OF THE SOUL.  
THE PHYSIOLOGY OF BERNARDINO TELESIO IN OLIVA SABUCO'S  
*NUEVA FILOSOFÍA DE LA NATURALEZA DEL HOMBRE* (1587)

Marlen Bidwell-Steiner

*Summary*

Oliva Sabuco de Nantes y Barrera's *Nueva filosofía de la naturaleza del hombre* is a unique contribution to early modern physiological discourse. Over the last two decades there has been some interest in her work, mainly by feminist scholars, whose aim has been to defend the female authorship that had been disputed and subrogated to Sabuco's father. But this focus on the question of *autoría* has left the analysis of the philosophical framework of the text largely neglected. Only some of its highly intriguing metaphors have been discussed as isolated concepts to underpin its female authorship. Such an approach fails to situate the text within the most innovative aspects of Renaissance natural philosophy. In this article, I will offer a close reading of the rhetorical apparatus of the *Nueva Filosofía* to expose its gynocentric psycho-physiological framework, which elaborates on new concepts proposed by contemporary Italian materialists. In particular, I will suggest that, when considered against the backdrop of Bernardino Telesio's *De rerum natura*, Sabuco's text forms a consistent model of the interplay of body and soul.

Unlike modern scientists and scholars, natural philosophers of the Renaissance were not forced to specialise; instead, they focused on a wide range of issues which today comprise different fields, such as biology, metaphysics, astronomy, to name but a few. Their overall aim was to develop a system of principles that could be applied to *all* natural processes – in human bodies as well as in environmental phenomena, such as gravitation or tides.

At the end of the sixteenth century, one can trace a radical materialistic orientation in natural philosophy which transforms the view of the *microcosm* and of the *macrocosm* alike. The prerequisite for such an epistemic shift can be seen in a stronger emphasis on empirical knowledge formation in contrast merely to amending traditional strands. But as modern readers, we must be cautious: empiricism in that period does not yet imply conducting measurable series of experiments, but rather searching for the most unbiased records possible of observations of natural phenomena. Consequently, the function of the senses becomes highly

important. In examining the *microcosm*, the interaction between body and mind is reduced to exclusively natural processes.

In this article I will introduce a unique contribution to this discourse: Oliva Sabuco's *Nueva filosofía de la naturaleza del hombre*. Its uniqueness relies on two features; the female authorship and a highly original gynocentric model of the world, which is constructed using the elements predominant in contemporary natural philosophy. The mere fact that a woman of twenty-five was able to publish a philosophical text has raised some academic interest, mainly among feminist scholars.<sup>1</sup> However, the philosophical framework of the text has been largely neglected. Due to the almost complete lack of extant biographical data, with only scarce references offered by the text itself, any reconstruction of its possible sources relies on Sabuco's line of argumentation alone.

In this chapter, I will suggest that the relevant metaphors of the *Nueva Filosofía* form a consistent world model when considered against the backdrop of Bernardino Telesio's *De rerum natura*. The common aim of these two dissident authors was to reformulate the traditional humoral system into a concise and more convincing form. In this, they drew on centuries of medical tradition of humoral pathology, which by the sixteenth century had culminated in an almost overly elaborated intellectual system. In doing so, not only did they follow certain recent medical findings, but they also rediscovered classical and medieval sources of medical philosophy. The 'new Galen' is just one example of this: during the Middle Ages Galen's medical textbooks were received through Arab commentators, but in the sixteenth century new critical Latin editions of the Greek originals offered new readings.<sup>2</sup> In the authors I am studying here, the

---

<sup>1</sup> E.g. Waithe M.E. – Vintro M.E., "Posthumously Plagiarizing Oliva Sabuco: An Appeal to Cataloging Librarians", *Cataloging & Classification Quarterly* 35, 3–4 (2003) 525–540; Waithe M.E., Oliva Sabuco de Nantes Barrera, in *A History of Women Philosophers, II. Medieval, Renaissance and Enlightenment Women Philosophers A.D. 500–1600* (Dordrecht-Boston-London: 1989) 261–284; Otero-Torres D.M., "Oliva Sabuco de Nantes y la construcción del estado: Nuevas topografías sociales e institucionales, feminismos, cuerpos escrituras" in Zavala I.M. (ed.), *La Página* (Tenerife: 2000) 67–85; Otero-Torres D.M., "Texto femenino/autoridad masculina: problemas de autoría en torno a La nueva filosofía de la naturaleza del hombre (1587) de Oliva Sabuco de Nantes" in Calvo F. – Romanos M. (eds.), *Lecturas críticas de textos hispánicos. Estudios de Literatura Española del Siglo de Oro* (Buenos Aires: 2000) 107–113; Rivera-Garretas M.M., "Las prosistas del humanismo y del Renacimiento (1400–1550)" in Zavala I.M. (ed.), *Breve historia fememista de la literatura española (en lengua castellana)* (Barcelona: 1993) 83–131; Rivera-Garretas M.M., "Oliva Sabuco de Nantes Barrera" in Zavala I.M. (ed.), *Breve historia fememista de la literatura española (en lengua castellana)* (Barcelona: 1993) 131–147.

<sup>2</sup> Hankinson R.J. (ed.), *The Cambridge Companion to Galen* (Cambridge: 2008).



combination of innovative methods and speculations based on a wider range of texts resulted in a focus on bodily fluids, namely the spirits. These subtleties of the human fabric offered a plausible model of explanation for physiological processes otherwise difficult to explain, such as perception. Interestingly, and in accordance with their materialistic focus, in the texts of Telesio and Sabuco perception further acts as a metaphorical explanation for intellectual operations. The two authors both emphasise a fluid and permeable organisation of the body with *one* vital sap responsible for such different activities as sight, emotional response, and cognition. By hypothesising one spirit, or soul liquid, instead of three, they are thus eroding the dichotomy between matter and mind, strongly in favour of the former.

So far, their innovations are parallel. But whereas Telesio, in accordance with the physiological tradition, assumes the most subtle quality for his *spiritus animalis*, Sabuco refers to the crudest metabolic substance, the *chylos* (Spanish: *chilo*) as 'ur-liquid of life'.<sup>3</sup> This discrepancy between the two texts helps us to grasp Sabuco's world model as a gynocentric inversion of Bernardino Telesio's physiological concepts, as I will show below, after first outlining Telesio's own highly innovative ideas.<sup>4</sup>

### *What Matters. Hot and Cold*

Bernardino Telesio owes his status within the genealogy of famous philosophers first and foremost to Francis Bacon, who called him the 'first of the moderns'.<sup>5</sup> In fact, Telesio's radicalisation, or to be more precise, his radical simplification of cosmology and of physiology, paved the way for empirical and mechanical conceptualisations which culminated in the

<sup>3</sup> Waithe, *A History of Women Philosopher*, vol. II, 275.

<sup>4</sup> In order to trace possible direct readings of Telesio's work by Sabuco, I mainly used the edition of his second *De rerum natura iuxta propria principia* (Naples, Iosephus Cacchiuss: 1570) by Roberto Bondi (1999) given the fact that the last edition was published in 1586 (Naples, Horatium Salvianum), a time when Sabuco's own text was already in production (ed. 1587). The quotes from Sabuco's work are taken from the second edition (1588), due to the fact that there is a copy of it in the National Library of Vienna, which bears no marks of censorship. A comparison with the *editio princeps* at the National Library of Madrid proved that it is technically identical with the first edition except for the author's amendment of a table of contents and some minor corrections.

<sup>5</sup> Bacon Francis, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 7 vols. (London: 1887–1901 [Repr. Stuttgart-Bad Cannstatt: 1963] 114).

so-called Scientific Revolution. It seems surprising, however, that his philosophical innovations were so widely received, since he was never part of the leading intellectual circles of contemporary Italy, but rather worked independently on the periphery. After years of voluntary seclusion in a Benedictine convent, he returned to his hometown of Cosenza where he seems to have systematically deconstructed ancient texts from the Aristotelian and the Galenic corpus. Initially, his ideas were presented only to his pupils of the Accademia Concentina, as he published the first edition of his *De rerum natura iuxta propria principia* (Rome, Antonio Blado: 1565) at the fairly mature age of 56. His further scholarly efforts can be described as the reformulation, re-elaboration and extension of this *opus magnum* with two more versions in 1570 and in 1586.

Today's scientific community still disagrees about Telesio's motives for these textual revisions. Most of them refer to his concept of *anima*: whereas the first edition deals exclusively with a material and therefore *mortal* soul, the following editions tend to differentiate more and more between an *anima ex semine educta* and an *anima a Deo infusa*. Some scholars interpret these modifications as a consequence of Averroes' heritage: Mulsow, for instance, suggests that Telesio bases his argument on the assumption of an *anima mundi*, but does not further develop it as it becomes irrelevant due to the Fall of Man.<sup>6</sup> Leen Spruit offers an interesting explanation for the reason why Telesio argues for a divine soul. This explanation is in line with Telesio's own pragmatic argumentation: Spruit states, that if human beings have a notion of immortality, there must be something eternal that corresponds with it.<sup>7</sup> Even if one agrees with such subtle interpretations, Bondi's conclusion that we should read the modifications in Telesio's psychophysiology as a concession to an ever more rigid censorship in the Counter-Reformation seems, in my opinion, highly plausible, considering Telesio's overall argument.<sup>8</sup>

In any case, Telesio does not elaborate on metaphysical principles, but rather puts emphasis on the material world. The core concept of his philosophical edifice is a reduction of the Aristotelian fourfold qualities (heat, cold, moisture, and dryness) to two antagonistic principles, heat and cold,

---

<sup>6</sup> Mulsow M., *Frühneuzeitliche Selbsterhaltung. Telesio und die Naturphilosophie der Renaissance* (Tübingen: 1998) 285.

<sup>7</sup> Spruit L., "Telesio's Reform of the Philosophy of Mind", *Bruniana & Campanelliana* 3 (1997) 129.

<sup>8</sup> Bondi R., *Introduzione a Telesio* (Rome-Bari: 1997) 123–135.

with the former definitely being the more important one. To disregard moisture and dryness as such is not all that revolutionary, as Galen had already hinted at this possibility.<sup>9</sup> The more striking innovation in Telesio's teleology is the interaction of these primary agents, cold and heat, with matter. According to Karl Schuhmann, Telesio implies or even argues that matter is, in fact, corporeal, and in postulating this "he participates in that broad movement which eventually led to the ontological upgrading of matter".<sup>10</sup> This is a clear break with Aristotle, to whom matter as a principle is incorporeal.<sup>11</sup>

In contrast, matter in Telesio's view never diminishes or grows. It is the most stable principle and can be characterised as not being in need of anything, a feature that releases it from the Aristotelian idea of *privation*. Thus, the formal variety of our sensual world is not the result of a destitute and appetitive matter, but rather it emanates from the battle between heat and cold.

Telesio's cosmology offers another important rejection of peripatetic concepts by assuming that the supra-lunar world and the sub-lunar world have identical components, albeit in varying degrees. I consider this to be a further example of his far from metaphysical approach, since an *anima mundi* loses its argumentative basis if heaven is only a more subtle structure of the same principles which can be found down on earth:

[...] indeed as any acting nature, whatever it is like, is never unaware of its own character and never desists from acting, but fights and chases even natures that are similar and akin to it in order that it may increase itself in their foundations because it strives for the greatest measure of itself, conserving and diffusing itself as much as possible to produce itself in any substratum. Therefore as already stated, the acting principles of these things appear to be heat and cold.<sup>12</sup>

<sup>9</sup> Galenus, *De elementis secundum Hippocratem* (1.494–495, 142, 1–6 K.); for further explanations see Hankinson, *Cambridge Companion* 219.

<sup>10</sup> Schuhmann K., "Telesio's Concept of Matter", in Accademia Consentina (ed.), *Atti del Convegno Internazionale di Studi su Bernardino Telesio* (Cosenza 1990) 115.

<sup>11</sup> Aristoteles, *Physica* 1.9.

<sup>12</sup> Telesio Bernardino, *De rerum natura* (1999) 38 'qualiscunque enim existit natura agens quaevis nunquam proprii ingenii oblita numquam agere cessat, sed vel similes cognatasque oppugnat deturbatque, ut in earum se ipsam sedibus amplificet qualiscunque est talis esse servarique et diffundi amplius atque in subiectis produci omnibus summe appetens summeque contendens. Quod igitur dictum est agentia rerum principia calor esse et frigus videntur'.

*From cosmology to physiology to psychology*

Although Telesio technically rejects an epistemology that is based on rhetoric, he sometimes uses analogies due to the lack of a better alternative. As a consequence, we can rediscover his cosmological principles in his anthropology:

Also the existence of the spirit, the very foundation of Telesian psychology, is impossible to prove directly by the senses, but must be inferred from observed behaviour. Yet, it is necessary to postulate the existence of an ethereal and fiery substance in order to explain the phenomena of perception.<sup>13</sup>

In order to elaborate on Telesio's model of the workings of the spirit, a short summary of how psychophysiological processes were previously conceived is necessary. Basically, certain Aristotelian qualities are linked to a complex system of humours that form the temperament of the body. More sophisticated physiological processes are fuelled by what today might be referred to as 'transmitter substances', or, in the language of natural philosophy, 'spirits' and 'species'. In the first place, the 'vital virtues' (as Nancy Siraisi termed the spirits in 1990) have the task of harmonising and stabilising the body parts. However, these subtleties of the human fabric serve as a plausible model of explanation for physiological processes that are otherwise difficult to explain (i.e. perception). As such, they also act as a mediator between the inside of the body and its environment, be it nurture, climate, or passions.

The dominant concept can be traced back to a blending of Aristotelian philosophy with Galenic medicine:<sup>14</sup> during the processes of the human soul, *spiritus* and *species* act as mediators between matter and form, albeit in complex ways. The material environment irradiates *species*, a sort of ray, to the sense organs, which in turn produce images or *phantasmata* in the first faculty of the brain, the *sensus communis*. The term *species* refers to a translation of the Aristotelian concept of *eidos* and therefore is analogous to *forma*.<sup>15</sup> *Spiritus* is a subtle vapour that carries the *species* and fuels life processes throughout the organism. In the Galenic system, the *spiritus* as a 'transmitter substance' has a tripartite structure, an idea which

<sup>13</sup> Spruit, "Telesio's Reform" 127.

<sup>14</sup> Aristoteles, *De anima*; Galen, *De elementis secundum Hippocratem*.

<sup>15</sup> For further definitions see Spruit L., *Species Intelligibilis. From Perception to Knowledge. Renaissance Controversies, Later Scholasticism and the Elimination of the Intelligible Species in Modern Philosophy* 2 (Leiden-New York-Cologne: 1995).

corresponds to Aristotelian psychology: the *spiritus naturalis* resides in the liver and is responsible for digestion and metabolism, the *spiritus vitalis* can be localised in the heart and is active in all kinds of affections and motions, and the *spiritus animalis* is situated in the brain and controls higher activities of the soul, such as intellect.

In a clearly Aristotelian tradition of equating the soul with life itself, Telesio endeavours to simplify the theory of its operations by emphasising sensation. Hence, in accordance with the most innovative of contemporary natural philosophers, he discards the conception of a threefold soul. Instead, he establishes one single life sap that not only controls all activities in all creatures – an idea already expressed by others<sup>16</sup> – but also acts as the *substance* of the soul itself. This is already hinted at in the title of one of his shorter texts, which were posthumously edited by his disciple Antonio Persio: *Quod animal universum ab unica animae substantia gubernatur* (Venice 1590). A similar position can be found in the other versions of his *opus magnum*:

Even though they [the peripatetics] cannot demonstrate it, they cannot claim that it is the instrument of the soul, but rather the substance of the soul and even the soul itself, respectively this spirit which is present in all things, a feature of the semen and of all its products with the exception of bones and things similar to bones.<sup>17</sup>

Katherine Park points out the innovative quality of this reappraisal:

In Telesio's *De rerum natura* (1586) *spiritus* appeared no longer as the instrument of the organic soul, as it had been for Reisch and the rest, but as its very substance – a position he attributed to Aristotle himself.<sup>18</sup>

Thus, he reverses the traditional model by asserting the substantiality of the soul and the instrumentality of the body: what was formerly seen as a sort of transmitter fluid changes into the materiality of *anima*, which resides in the ventricles of the brain, from which location it operates throughout the whole body via the nerves.

<sup>16</sup> The most prominent exponents are Nicolas Cusanus, Jean Fernel, Girolamo Fracastoro and Miguel Servet among others.

<sup>17</sup> Telesio, *De rerum natura* (1999) 168 'Id si non praestent ne ipsis quidem animae organum, sed ipse animae substantia et anima ipsa videri debet, is nimirum spiritus qui e semine eductus est rebusque e semine constitutis unis ossibus ossibusque similibus rebus exceptis reliquis inest omnibus'.

<sup>18</sup> Park K., "The Organic Soul", in Schmitt C.B. – Skinner Q. (eds.), *The Cambridge History of Renaissance Philosophy* (Cambridge: 1988) 464–485.

Nevertheless, the soul-spirit is of the subtlest substance, which makes the analogy to his cosmological model evident: for Telesio, the active principle of heat is equivalent to light. Therefore, the hotter a being, the more refined are its qualities. Moreover, heat is responsible for motion, and in this context it becomes clear that life as heat is *both* spirit *and* motion: 'Therefore one has to state that heat as a product of motion, which is a product of heat's own operation, is a product of the substance of heat'.<sup>19</sup> In this passage one also can trace an apparent inconsistency in Telesio's text, as he normally considers heat as a principle, not as a substance. In order to explain this contradictory formulation one needs to consider the cosmic seat of heat: Heaven, or to be more precise, the Sun becomes one of the two first bodies. In certain passages of his texts, Telesio uses the Sun as homologous to the quality of heat in order to stress his assertion that there are only these two creative elements. Together with Earth, where cold and matter reside, Sun is the *artifex* of all things. All beings are made out of the antagonistic forces of these two first bodies, their battlefield mainly being the surface of the Earth.<sup>20</sup>

In order to follow Telesio's explanation for the variety of things, it is necessary to scrutinise his notion of heat. Heat is equated with light, and as such it is very supple and versatile. Hence, motion and heat are closely connected: in a way, the versatility of our sensual world is the product of differently heated objects acting upon each other. The key paradigm of this acting is tangibility: every transformation is a result of dilatation or contraction following an agreeable or an objectionable touch. Heat acts by dilating, moving, and rarefying things; cold acts by condensing and keeping things stable. What is true for the outside world again applies to psychophysiological processes: perception is a delightful or abhorrent affection of the spirit by means of the senses – experienced as pleasure or as pain.

Motion in general is a key concept of Renaissance natural philosophers. They invested much effort into tackling the highly speculative twofold Aristotelian system of *energeia* and *dynamis*. Telesio suggests that affections, understood as motions, are not unidirectional, since the spirit is actively striving for movement by following its major aim of self-preservation. In the course of sensation, the spirit is pursuing its natural operation.

---

<sup>19</sup> Telesio, *De rerum natura* (1999) 100 'Calor itaque a motu factus, a propria caloris factus operatione, a caloris substantia factus videri debet'.

<sup>20</sup> Telesio, *De rerum natura* (1999) 10–25.

Thus, he uses the term *actio* to denote a push, a physical action of one thing bearing upon another, and *operatio* for its inner operations.<sup>21</sup> Consequently, spirit as the “seed-soul” of all creatures is not a mere potentiality, but rather an active substance: ‘Telesio believed that the soul comes to grasp natural reality by means of physical interaction’.<sup>22</sup> In this context, it becomes evident that this peripatetic theory of *species intelligibilis* as a phantasmatic and immaterial form is discarded: Telesio goes for the real thing.

This approach also offers a new concept of memory; one which no longer serves as an ‘image library’ in the last ventricle of the brain, but instead becomes genuine embodied experience. This brings us to a key topic that has been covered most prominently in scholarly literature: Telesio’s theory of cognition.<sup>23</sup> Basically, there is a general agreement on the fact that cognition functions analogously to sensation because, ultimately, there is always some sort of external impetus. As an underlying aspect in this specific spiritual operation, *memoria* is involved as the surplus negotiator. In Telesio’s account, *memoria* becomes a bodily remembrance of a past movement of the spirit.

In my opinion, this idea cannot be merely ascribed to Telesio’s overall ‘reductive strategy’.<sup>24</sup> Instead, it nourishes his deep conviction that abstract speculations are feeble. In contrast to Aristotle’s psychology, Telesio faces the problem of errors in human cognition: false responses can only be explained by assimilating actual stimuli with the ‘wrong’ embodiment of past experiences. However, the same framework offers a materialistic model for human knowledge acquisition, as bodily recollection may modulate further responses. Once more, there are no eternal forms or images involved, but everything is based on the materiality of the unique physiological fluid.

Before confronting the original ideas of this Southern Italian philosopher with those of his near-contemporary, the female Spanish writer Oliva Sabuco de Nantes y Barrera, it will be helpful to recall the most important items as key words: namely, heat and cold as acting natures; matter as

<sup>21</sup> See Telesio, *De rerum natura* (1999) 18–20.

<sup>22</sup> Spruit, *Species Intelligibilis* 201.

<sup>23</sup> E.g. Kessler E., “Selbstorganisation in der Naturphilosophie der Renaissance”, *Selbstorganisation. Jahrbuch für Komplexität in den Natur-, Sozial- und Geisteswissenschaften* 3 (1992) 15–29; Bondi, *Introduzione a Telesio*; Mulsow, *Frühneuzeitliche Selbsterhaltung*; Boenke M., *Körper, Spiritus, Geist. Psychologie vor Descartes* (Munich: 2005).

<sup>24</sup> Spruit, “Telesio’s Reform” 124.



stable nature; spirit as substance residing in the ventricles of the brain; 'tactile' motion as contraction and dilatation; and cognition as amplified sensation.

*The Upside-Down Philosophy of Oliva Sabuco de Nantes y Barrera*

The reception of the Spanish writer Oliva Sabuco de Nantes y Barrera attests to a well-known phenomenon in feminist studies: the loss of biographical data goes hand in hand with the appropriation of her highly original work. The authorship of her *Nueva filosofía de la naturaleza del hombre* (Madrid, 1587) was disputed and the work was attributed to her father. In this case, the dubious strategies of a patriarchal scientific historiography become more than evident due to the fact that the usurpation took place about 350 years after the first publication of her successful text; two further editions had appeared during her lifetime and a further six versions before the dispute, all under her name. A team of American scholars has carefully reconstructed the circumstances of this act of plagiarism. They convincingly argue that the flimsy evidence of 'rediscovered' documents is totally unfounded.<sup>25</sup> But their pioneer work of reconfirming the original authorship is not sustained by their English translation of the *Nueva filosofía*, as this lacks a careful contextualisation of the basic principles of Sabuco's text. Fortunately, Gianna Pomata has recently published a highly readable English translation of one core dialogue. But she again treats the question of authorship as unresolved, although she does not adduce convincing evidence for yet another examination of this vexed question.<sup>26</sup>

In fact, no reconstruction of sources for, or influences on, Sabuco's text can be based on indisputable proof. Apart from the fact that she published the *Nueva Filosofía* at the early age of twenty-five, her biography remains obscure. There is no documentation on the precise date of her death, and we know only a little about her intellectual upbringing. She certainly spent her earliest years with the Carmelites. The widespread assumption that the famous Spanish humanist, Simon Abril, was her teacher is based simply on the fact that he was a native of the same city as

<sup>25</sup> See Waithe M. E. – Vintro M. E., "Posthumously Plagiarizing Oliva Sabuco" 525–540.

<sup>26</sup> Pomata G., Introduction, in *Oliva Sabuco de Nantes Barrera. The True Medicine* (Toronto: 2010) 1–85.

Sabuco, Alcaraz, where he taught for several years. In any case, the young author would have benefited from a lively intellectual environment since her father, a pharmacist, and her godfather, a physician, participated in the local humanist culture.

Sabuco's writing shows clear evidence of humanist influence: she adopts an anti-scholastic attitude and postulates experiential knowledge as superior to academic tradition. This popular humanistic strategy does not allow for extended discussions of the positions in theoretical debates. But although she only rarely quotes canonical sources such as the works of Plato, Pliny's *Historia Naturalis* and Aristotle's natural philosophical texts, her playful use of philosophical paradigms shows her as being fully acquainted with the most contested issues of contemporary natural philosophy.<sup>27</sup> To grasp Sabuco's line of argumentation and its references, we must therefore turn to a close reading of her own text.

Sabuco's eclectic cross-reading of physiological concepts reveals her strategic intention to deconstruct the androcentric conception of the world within its own terms of signification. To that aim, she reshapes peripatetic, Galenic, and Platonic ideas into a materialist and holistic model of the body by means of rhetorical recombination. This strategy proves that she is well aware of the materialistic branch of natural philosophy that was particularly dominant in the Mediterranean at this time, even though she only rarely quotes any contemporaries. In order to reveal the systematic construction underlying Sabuco's core tropes, it is necessary to explore the most radical materialistic approaches of contemporary natural philosophy developed by Paduan Aristotelian philosophers, such as Pietro Pomponazzi. Even so, the main features of her physiological innovations and the specific quality of the constituents of her *Nueva filosofía* are significantly close to Bernardino Telesio's model.

Like Telesio, Oliva Sabuco puts much emphasis on the interface between body and soul. One question associated with *anima* in early modern texts concerns its presumed location within the human body. On this point, Sabuco offers one of her strongest metaphors: in the *Nueva Filosofía*, humans are described as *Arbol del revés*, a reversed tree. This

---

<sup>27</sup> As Pomata discovered, Sabuco took most of the classical quotations from a very influential text of Francisco Valles, who was head of the medical school in Alcalá and a famous translator of Aristotle, Hippocrates and Galen. See Pomata, Introduction, 36–37. I do not share the opinion that Sabuco was 'competing with Valles' because, in his *Controversiarum medicarum et philosophicarum libri X* (Alcalá 1556), the latter pursues a very different argumentation in line with scholastic rhetoric.

imagery outlines the full complexity of Sabuco's reworking of the images she inherited: the head as *raíz*, root, seems to indicate a close connection between the human soul and the *anima mundi*, because as it is pointing to heaven, it is prone to cosmic forces. This conception calls to mind the Neoplatonic *nodus mundi*, an immaterial essence. In fact, Sabuco seems to have borrowed the tree metaphor from Plato's *Timaeus*.<sup>28</sup> An almost contemporary parallel can be found in Leone Hebreo's *Dialoghi d'Amore*,<sup>29</sup> where this exiled Portuguese physician too uses Neoplatonic ideas to construct a clearly materialistic concept of the interplay between the soul and the body.

Likewise, the *Nueva filosofía* does not engage in metaphysical speculations. As in Telesio's texts, Sabuco's brain soul not only features sublime intellect. In practical terms, the brain's ventricles are the trading centre for all vital processes. Sabuco reduces *facultas*, an independent capacity, to being a quality of the heart and the liver. The latter works almost mechanically: '[...] because the nature of the liver cannot err, it is learned without a doctor'.<sup>30</sup> Together with the heart and the spleen, the liver forms the three 'embers' that support the brain as the unique animated organ by stimulating the metabolism. Here, we find Telesio's antagonistic forces of heat and cold in the interior of the body, as heart, spleen, and liver appear to be hot, enabling digestion, while the spirit itself remains cold throughout the body. Consequently, Sabuco reduces the threefold spirit to one single vital sap which she refers to alternately as *espírito*, *sangre blanco*, and *chilo* (spirit, white blood, chyle).

Whereas in traditional humoral theory the term *chylos* was defined as the earthiest of the humours, Sabuco re-signifies this substance of digestion as a vehicle of the soul that holds the capacity of form. Thus, she emphasises the important status of matter, which since Antiquity had been metaphorically associated with the feminine. This reading is further supported in her rhetorical programme, which is dominated by metaphors stemming from the source domain 'mother'. In the following, I will trace these female structural figures – *natura madre/natura madrastra*, *pia madre*, and *luna madre* – in order to show further parallels, as well

<sup>28</sup> Plato, *Timaeus* 90a–b.

<sup>29</sup> Ebreo Leone, *Dialoghi d'amore* (Bari, Antonio Blado: 1535), ed. Caramella S. 1929: 87.

<sup>30</sup> Sabuco de Nantes y Barrera Oliva, *Nueva filosofía de la naturaleza del hombre, no conocida ni alcançada de los grandes filosofos antiguos. La qual mejora la vida y salud humana* (Madrid, Pedro Madrigal: 1588<sup>2</sup>) fol. 207l 'porque la natural del higado, no sabe errar, es docta sin doctor'.

as illustrating the disagreement between *Nueva filosofía* and Telesio's physiology.

One important parallel between the two authors is the rejection of the concept of *privation*, which is substituted by the representation of two natural agents, albeit with a special twist in Sabuco's text, to which I will refer later:

[...] therefore any matter maintains friendship with its form and assumes it. It assumes not the one of which it was deprived, but the one with which it is in friendship. Therefore philosophers better call privation *amicitia*. They certainly erred in postulating this principle, for there are only matter, *amicitia* and form, and the three of them stay mixed. Thus it takes as long as the *amicitia* takes, which the matter maintains with this form.<sup>31</sup>

In this context, the concept of friendship seems to refer to Girolamo Fracastoro's paradigm of *sympathia*, an ontological order in which all things act according to their predisposition.<sup>32</sup> But an allusion to friendship reappears when Sabuco describes reproduction. Here she suggests a model of 'love companionship' that clearly defeats Aristotle's idea of the predominance of the male contribution to conception:

[...] so the man will see, how much the companion, whom he takes as wife, contributes to the perfection of his children. And the woman [will see the contribution] of the companion, whom she chooses as her partner, since out of two good materials results a good third one. Thus, the male and the female partner each contribute their half. This is why Aristotle, very accurately, compared children with a link that ties together the chain in the middle, as one half comes from the father and the other one from the mother, to the child, and thus father and mother stay bound to their children.<sup>33</sup>

The comparison of metaphors of the same source domain, on two different levels of text, helps further to uncover Sabuco's objective. In her description

<sup>31</sup> Sabuco, *Nueva Filosofía* fol. 250l-r 'De manera que cada materia tiene amistad con su forma, y aquella toma, y no otra de que es priuada, sino a la que tiene amistad: y mejor dixeran los filosofos a la priuacion *amicitia*: y cierto erraron en poner este principio, sino materia *amicitia*, y forma, y quedan todos tres en el mixto: y assi dura segun dura la *amicitia*, que tiene la materia a aquella forma'.

<sup>32</sup> For further interpretations on this re-elaboration of Stoic concepts, see Boenke 74–120.

<sup>33</sup> Sabuco, *Nueva Filosofía* fol. 171l 'y así verá el hombre cuanto va en la compañera que toma por mujer, para la perfección de sus hijos. Y la mujer cuanto va en el compañero que toma por el semejante, que de dos materias buenas resulta tercera buena: pues el compañero, o compañera, ha de poner la mitad; por lo cual a los hijos comparó Aristóteles, y muy bien a eslabón, que ata la cadena en medio, porque el padre puso la mitad, y la madre la otra mitad en el hijo, y así quedan atados el padre, y la madre con los hijos'.

of the concrete bodily functions she constructs an egalitarian relationship between women and men. Yet, when she outlines the metaphysical foundations of such a proto-feminist approach, she opts for a gynocentric model, and thus for the priority of the feminine. In doing so, she subverts the well-known male strategy of proclaiming the inferiority of women.

As outlined above, the two *naturae agentes* in Telesio's work are heat and cold, their primary bodies being Sun and Earth. I consider that Sabuco seizes a significant inconsistency in Telesio's model in order to construct a rhetorically congruent gynocentric psychophysiology: Telesio thoroughly examines the actions of heat, yet the concrete workings of the antagonistic cold are more or less kept in the dark. This becomes even more complicated because its seat is Earth, which is also a residue of matter. Furthermore, Telesio emphasises that the *naturae agentes* are always intrinsically tied to their substrate, which makes the whole concept slightly fuzzy:

[...] if, in fact, as it appears, the diversity and deformity of either only the heat or only the matter is sufficient to constitute diverse beings, this is even more the case, when all these diversities are united and associated; they constitute an almost endless form of beings and some others that can be judged as constituted from both natures.<sup>34</sup>

Sabuco further mingles the two principles of matter and cold to the extent that matter becomes a formative nature, effected by cold. As *natura madre*, Mother Nature, it maintains a sibling relationship with the principle of Sun; in Sabuco's words, *natura madrastra*, nature as foster mother. In the *Nueva Filosofía*, these sister natures take control of the dynamics of (human) life:

For the natural or proper [movement] we already stated that it only has two contraries that cause a major decrease: time and semen. This semen is the end of the proficient stepmother nature and the principle of the emerging mother nature. She gives this principle to the sister to put it in shape for the conservation of the species that she herself cannot conserve, and she gives it to her regret and detriment. And with this principle she pays back to the one of the semen that which she obtained, but better, and in better shape.<sup>35</sup>

<sup>34</sup> Telesio, *De rerum natura* (1999) 50 'nam si vel caloris solius vel solius materiae diversitas difformitasve per se quaelibet ad diversa entia constituenda satis videtur, eo magis simul copulatae coniunctaeque omnes innumeras pene entium species faciant, et quasdam quae a natura utraque effectae constitutaeque videri possint'.

<sup>35</sup> Sabuco, *Nueva Filosofía* fol. 235l-r 'El natural (movimiento), o propio, diximos que tenia dos contrarios solos que le causauan el decremento mayor, que son tiempo, y simiente: la qual simiente es fin de natura madrastra perficiente, y principio de natura

Mother Nature corresponds to the proper motion and the proper temporality of all beings and is, to some extent, equivalent to Telesio's concept of *operatio*. On a physiological level, Mother Nature is equated with *humiditas radicalis*, a traditional term in natural philosophy, which Sabuco links to the quality of her soul liquid, *chilo*. Like a real mother, *natura madre* arranges adequate nurture for the *species*. In this context, Sabuco emphasises the ambiguity of the notion *species*: through the image of the shaping of the human embryo, she points to the processing of *natura madre* for the broader semantic field of corporeal shaping in more detailed contexts. This is further elaborated on in the quality of the soul sap, which is very versatile but principally always the same white brain liquid:

To say that sperm and milk are red blood that becomes white in its vessels is ridiculous. What I told you about the white blood or the great working of the white brain liquid is not meant to scare you, doctor. Just look at what it does when it falls into the female uterus, where it makes an entire new animal with the irrigation and the nourishing of the menstrual blood. Thus, it takes much more to make a totally new body than to expand what already is [...].<sup>36</sup>

In Sabuco's model, the operating of the *spiritus* is initiated by a physical impulse of the *natura madrastra*, either through affection or through any other environmental influence. Like her Neapolitan precursor, Sabuco visualises the act of sensation as a tactile process. Therefore, any physiological reaction can be reduced to a delightful or an objectionable stimulus, which she illustrates by referring to the very action of the brain. Here, the next mother figure enters the scene: the inner brain membrane, the *pia mater*, is metaphorically upgraded to a female sub-lunar primary mover: 'pia mater [pious mother] pursues unperturbed its office in secret (which is to take and to give) [...] this the soul does with the movement of the pia mater, who is the hand of the soul'.<sup>37</sup>

---

madre principiante: el qual principio da a la hermana para que lo ponga en forma para conseruacion de la especie que ella no puede conseruar, y dalo a su costa y daño: y con este principio que ésta el de la simiente le paga el que recibio mejor, y en mejor forma'.

<sup>36</sup> Sabuco, *Nueva Filosofía* fol. 243 'Es cosa de risa lo que dizen, que la esperma y la leche son sangre colorada, y que en sus vasos se buelue blanca: y desto que he dicho (señor Doctor) desta sangre blanca, y sus grandes obras deste xugo blanco del cerebro, no os espanteys pues veys lo que haze caydo en el vtero de la hembra, que haze de nueuo todo el animal con el riego y sustento de la sangre de menstuo, que mas es hazer el cuerpo todo de nueuo, que aumentar lo hecho'.

<sup>37</sup> Sabuco, *Nueva Filosofía* fol. 67 'La pía madre está firme haciendo su oficio, oculo (que es tomar, y dar) [...] esto hace el ánima con el movimiento de la pía madre, que es la mano del ánima'.

Like Telesio, Sabuco postulates two resulting movements: dilatation and contraction. The substance of the brain, therefore, is pushed by its enclosing integument. In her matter-of-fact style, the intertext for their common emphasis on touch becomes more evident: the *pia mater* as the hand of the soul is a clear reference to the theory of Anaxagoras, as outlined in Aristotle's *De Anima* (431b29–31). However, Sabuco does not go as far as Telesio in openly objecting to the Aristotelian model of *species*. In her text, it appears as a sensual pictorial impression, which can be both invigorating and harmful. Nevertheless, the reaction of the *chilo* is cast in the same materialistic framework as in *De rerum natura*. When a harmful species enters the organism, the *chilo* puts all its effort into getting rid of the damage.

At this point, we find the core idea of disease in Sabuco's text. The *pia madre* pushes the *chilo*, which sinks through the anterior or posterior nerve tracts to divert the injury. The first situation indicates an insignificant ailment, while the latter leads to a serious malady. The overriding aim of Sabuco's substance of *chilo* or *sangre blanco* is self-preservation, which is also the key concept in Telesio's epistemology.<sup>38</sup> Hence, in the situation of wellbeing, the *chilo* bubbles up to the vertex, from there to nourish the whole organism by way of the nervous system.

The imagery in Sabuco's sophisticated rhetorical strategy is the helix that finds its anatomic counterpart in the spinal cord. In other words, in the *Nueva Filosofía*, physiology is explained in terms of maelstrom movements. The idea of a flowing concept of life is also important in Telesio's text(s), as it enables him to explain the variety of all things. Concerning this concept, he even uses a metaphorical expression, although he generally tries to avoid figures of speech: '[...] Thus, the progress of any acting nature is not [abrupt] saltation but a certain kind of flow [...].'<sup>39</sup> Sabuco adopts the idea of an agile and fluid set of human processes, although in a different semantic frame:

[...] likewise man knows its conditions and has these two movements, a proper one and a violent one, just as [do the planets]. And the liquid rises and falls off its root and rains as it does in the macrocosm with the humidity or milk of the moon. This is why man never is the same nor can he stay in a [specific] being as we cannot enter twice the same water of a flowing river.<sup>40</sup>

<sup>38</sup> See Mulsow, *Frühneuzeitliche Selbsterhaltung*.

<sup>39</sup> Telesio, *De rerum natura* (1999) 40 'naturae enim agentis cuiuscunque progressus non saltus, sed quasi fluxus quidem existit'.

<sup>40</sup> Sabuco, *Nueva Filosofía* fol. 134r '[...] y assi el hombre sabe a sus condiciones, y tiene estos dos mouimientos, propio, y violento, como ellos, y sube, y abaxa el xugo de su rayz,



This last quotation highlights the discrepancies between these two materialist physiologies by showing a clear-cut difference between the two frameworks. As mentioned before, Telesio's core principle for all vital processes is heat. Sabuco, in her turn, adopts his principle of heat in close relation to semen, but disregards its importance. In her overall concept, the white soul substance *chilo*, or *sangre blanco*, assumes the quality of cold which is linked to its cosmic seat, the moon:

Thus the air that encloses us and which we breathe is refined water and the main nourishment of the root, that is, the brain [...] Avicenna says that the humours increase with the waxing moon and likewise the brain in the skull (which is the helmet) increases, and the water in the rivers and the sea. All of this the nutritive mother moon does with its milk, the chyle of the world, which is the water.<sup>41</sup>

Sabuco opts for a highly dissident position for, apart from the example of Hippon, which had already been discarded by Aristotle for being too devious,<sup>42</sup> there are no other 'cold models' around. Why would she expose herself to such a burden of proof? There are at least three good reasons for such a claim. All are congruent with Sabuco's use of rhetoric, which is the common way of reasoning in the Early Modern period. In so doing, she constructs a strikingly convincing line of argument, but at the same time does not go as far as Telesio in developing a new philosophy. This double bind is illustrated in her definition of the soul liquid: as already mentioned, her *chilo* resides in the brain ventricles, a location which traditionally is conceptualised as cold. Taking this as a starting point, she outlines a chain of analogies, which point to the doctrine of signatures, a preferred intellectual mindset in her time.

In classical and early modern mainstream natural philosophy, not only the brain is cold, but the same is also true for the uterus and, in a metonymic sense, for women. On a cosmic level this idea is extended to the moon, which symbolically corresponds to 'woman'. Sabuco puts great emphasis on this context by using the mother tropes, with the nourishing

---

y llueue como en el macrocosmo con la humedad, o leche de la Luna [...] Y por esso el hombre nunca es uno mismo, ni se puede retener en un ser como no podemos entrar dos veces en la misma agua de un río que corre'.

<sup>41</sup> Sabuco, *Nueva Filosofía* fols. 87–88 'De manera que el aire que nos cerca, con que respiramos, que es agua rara, es el principal alimento de la raíz, que es el cerebro [...] Dice Avicena, que los humores crecen con el aumento de la luna, y crece el cerebro en el cráneo (que es el casco) y el agua en los ríos, y mar. Esto todo hace la luna madre nutriz, con su leche chilo del mundo, que es el agua'.

<sup>42</sup> Arist. *De An.* 405a30.

mother moon at the top. The soul liquid takes its qualities from rain and air. The whitish and watery substance of *chilo* is easily built into the overall framework with cold as the guiding principle because its habitat, the nervous system, is believed to be cold, too. Thus, Sabuco's model has the advantage that objects cold to the senses do not require a detailed explanation, as can be found in Telesio's assertions concerning the hotness of gemstones.<sup>43</sup> Furthermore, Sabuco is not encouraged to challenge peripatetic cosmology, as she does not link the fundamentals of her physiology to any supra-lunar forces.

However, the most convincing motive in introducing the moon as the second primary body is that it provides a more solid foundation for an epistemology in which two principles interact with matter. This becomes obvious in a rhetorical twist, which characterises her overall argumentation, namely the trope of chiasm:

[...] moon and sun, [the latter as] father and [the former as] mother, gave the qualities: two movements, a proper one and a violent one, like all the stars and the skies. I say two movements: a natural or proper one with only one major [cycle of] increase and decrease and only two contraries: time and semen, and the violent daily one with countless contraries.<sup>44</sup>

Thus, while in Telesio's theory cold and matter both share Earth as a seat, Sabuco offers a triad with Mother Moon as the seat of the cold and Father Sun as the seat of the heat. Earth remains the container of stable matter.

To summarise, by means of an astute combination of traditional natural philosophy and the most innovative of contemporary trends, Oliva Sabuco constructed a gynocentric model of the world. From today's perspective, this mother-cosmos has a rather esoteric twist. But its contextualisation within early modern discourses on natural philosophy proves that Sabuco had virtually no interest in magical explanations of physiology, such as action at a distance (as, for example, outlined in Girolamo Fracastoro's proposition of the interaction between body and soul). In contrast, the *Nueva Filosofía* offers a materialistic view with the core concepts of a substantial soul liquid in the brain, cold as a major principle, and touch as an explanation for sensation. Its radicalism lies in the fact that Sabuco's

<sup>43</sup> Telesio, *De rerum natura* (1999) 88.

<sup>44</sup> Sabuco, *Nueva Filosofía* fol. 233r '[...] y Luna y Sol, padre y madre, dieron las calidades: Los mouimientos dos, propio, y violento, como de todos los astros, y cielos, digo los dos mouimientos, el natural, o propio con un cremento, y decremento solo mayor, y dos contrarios solos, tiempo, y simiente, y el violento de cada día con muchos y muchos contrarios'.

approach gives prominence to what had been a neglected principle in Telesio: coldness in interaction with matter. She thus implies that the nurturing quality of the *chilo* is at the same time a formative force. This results in a further twist of the Telesian version of Parmenides' coupling of active heat as an *artifex* and passive matter as a vessel. Taking this into consideration, *chilo* as a metabolic humour proves to be the appropriate wording for such an 'alimentary' concept.

One might wonder at this point what happened to Telesio's omnipotent principle of heat in Sabuco's account. As the analysis of the passages above implies, heat is 'incarnated' in the foster mother as a principle representing the external nature. Firstly, it is the seed, respectively the semen that initiates a simile, an explanation close to Telesio's concept. Furthermore, heat appears in sensual stimuli acting on the *natura madre*, which encompass affection, climatic influences, and nutrition. In sum, *natura madrastra* is necessary to activate the functions of every animated organism. This indicates that Sabuco adopts Telesio's ideas of *actio* for heat, in contrast to Mother Nature's *operatio*. But we cannot conclude that action ranks higher within the hierarchy of beings. This becomes evident in her explanation of cognition. In principle, as in *De rerum natura*, the spirit works by means of sensation but in the presence of memory. The discrepancy between the two authors helps explain why Sabuco adheres to the narrow notion of *species*: in her model, an incoming sensual form has to be modulated by the cold spirit in the brain. If the soul liquid were hot, the sensual input would melt away like a candle and could not be compared to the impressions of memory in order to derive the sense:

[...] for the species mix and fuse, melting due to the alien heat, or they dissolve as wax forms melt with heat or they collapse completely.<sup>45</sup>

Another important modification of Telesio's highly innovative philosophy concerns the idea of time. In his account, Telesio claims that time is a category of its own and independent of motion. In the *Nueva Filosofía*, time is defined as a quality of the sun, but with fatal consequences: whereas the *natura madre*, linked to the moon, aims at the preservation of the organism, the *natura madrastra*, linked to the sun, is prone to error and violence. And, finally, the starting point of life becomes the ultimate cause

<sup>45</sup> Sabuco, *Nueva Filosofía* fol. 215 recto 'porque las especies se mezclan, y confundense derritiendose con el calor extraño, o se deshazen como se deshazen las formas de la cera con el calor, o caen enteras con su forma'.

of death: 'Soul gave us life. Soul kills us with its affections'.<sup>46</sup> Like most early modern texts, Sabuco's way of dealing with such notions may seem confusing at times: this is one of the few examples of *anima* as a heated seed-soul, illuminated by the context of *natura madrastra*.

### Conclusion

Bernardino Telesio and Oliva Sabuco both adopt a materialistic approach that undercuts the hierarchy of beings. In Telesio's case, the ontological difference between animals and humans is blurred, as all vital processes are dominated by the same principle. Sabuco uses his framework to further balance out the hierarchy between men and women. As has been argued for both authors, the common heritage for their original frameworks is derived from Stoic and Epicurean philosophy.<sup>47</sup> Telesio offers his own view on the significance of classical influences in his reply to Francesco Patrizi's objections regarding the second edition of his *De rerum natura*. There, he points out that, in contrast to peripatetic paradigms, he uses the theorems of Parmenides to sharpen and develop his own philosophy.<sup>48</sup>

In this paper, I have offered a close reading of some key passages of Oliva Sabuco's *Nueva filosofía* in order to support my claim that her work is influenced by the philosophy of Bernardino Telesio. As shown here, Sabuco's radical ideas are expressed in some intriguing metaphorical narratives that might be mistaken as a naïve proclamation of an unusual counter-model to patriarchal cosmology. In order to reveal Sabuco's intentions, it is necessary to decipher her rhetorical apparatus. When reduced to its core signifiers, the framework of the *Nueva filosofía* can be identified as a sophisticated and sometimes quite witty comment on the more radical strands of contemporary natural philosophy in general. Moreover, I hope to have shown that some of the elements of Sabuco's physiology can only be understood in the light of Telesio's philosophy. Without Telesio's innovative substitution of the peripatetic triad of form-matter-*privation* with two antagonistic forces acting on matter, Sabuco's further insistence on the quality of coolness would lack an epistemological frame. Her account

<sup>46</sup> Sabuco, *Nueva Filosofía* fol. 257l 'El anima nos dio la vida: el anima nos mata con sus afectos'.

<sup>47</sup> See Kessler, "Selbstorganisation in der Naturphilosophie der Renaissance".

<sup>48</sup> Bondi, *Introduzione a Telesio* 56–65.

becomes intelligible only against the backdrop of Telesio's insistent postulation of the two acting natures, heat and cold. Admittedly, there is no tangible evidence for my claim of a direct influence of Bernadino Telesio's philosophy in the *Nueva filosofía*. But it seems unlikely that Oliva Sabuco would have picked exactly the same topics, choosing to select cold for further elaboration.

In all probability, Sabuco had worked with Telesio's text. A vivid cultural exchange existed between the Iberian Peninsula and Southern Italy, as the Kingdom of Naples was governed by Spaniards throughout the sixteenth century. Also, Telesio's Latin works were available in Spain. A late echo of his presence there comes in Benito Jerónimo Feijoo's *Teatro crítico universal* (1726–1739), a multi-volume collection of essays with a clearly educational intention. Feijoo mentions Telesio in volume 4, discurso VII, and in the same volume, discurso XIV, he wrote a chapter in praise of Oliva Sabuco. Another piece of evidence for philosophical concepts travelling between Spain and Telesio's intellectual environment can be seen in the fact that his pupil, Antonio Persio, wrote a treatise on the same subject as the highly popular Spanish physician, Juan Huarte de San Juan.<sup>49</sup> At the moment we cannot definitely be sure which books Oliva Sabuco had read and used. But to analyse her intricate text, I would argue that we should situate her amongst the "first of the moderns".

---

<sup>49</sup> Persio Antonio, *Trattato dell'ingegno dell'huomo* (Venice, Aldo Manutio: 1576) and Huarte de San Juan, *Examen de ingenios para las ciencias* (Madrid: 1575).

### Selective bibliography

- ARISTOTLE, *De anima*: ed. Barnes J. (1995) *On the Soul*, Princeton [*The Complete Works of Aristotle* 641–693].
- BACON FRANCIS, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England*, eds. Spedding J. – Ellis R.L. – Heath D.D., 7 vols. (London: 1887–1901) [Reprint Stuttgart-Bad Cannstatt: 1963 79–118].
- BIDWELL-STEINER M., *Große Welt – kleine Welt – verkehrte Welt. Die philogyne Naturphilosophie von Oliva Sabuco de Nantes y Barrera* (Innsbruck-Bolzano-Vienna: 2009).
- BOENKE M., *Körper, Spiritus, Geist. Psychologie vor Descartes* (Munich: 2005).
- BONDÌ R., *Introduzione a Telesio* (Rome-Bari: 1997).
- BRUNSCHWIG J., “Stoic Metaphysics”, in Inwood B. (ed.), *The Cambridge Companion to the Stoics* (Cambridge: 2000) 206–233.
- EBREO LEONE, *Dialoghi d'amore*: ed. Caramella S. (Bari: 1929).
- GALEN, *De elementis secundum Hippocratem*: ed./tr./comm. Lacy P. de (1996), *On the Elements according to Hippocrates* (Berlin) [CMG V.1.2].
- GÖTTLER C. – NEUBER W. (eds.), *Spirits Unseen. The Representation of Subtle Bodies in Early Modern European Culture* (Leiden: 2008) [*Intersections. Yearbook for Early Modern Studies*].
- HANKINSON R.J. (ed.), *The Cambridge Companion to Galen*. (Cambridge: 2008).
- HUARTE DE SAN JUAN, *Examen de ingenios para las ciencias* (Madrid: 1575).
- KESSLER E., “Selbstorganisation in der Naturphilosophie der Renaissance”, *Selbstorganisation. Jahrbuch für Komplexität in den Natur-, Sozial- und Geisteswissenschaften* 3 (1992) 15–29.
- KODERA S., “Three Elements instead of Four?” in *Disreputable Bodies. Magic, Medicine, and Gender in Renaissance Natural Philosophy, Essays and Studies* 23 (Toronto: 2010) 171–185.
- KRISTELLER P.O., “Telesio, Bernardino” in *Eight Philosophers of the Italian Renaissance* (Stanford: 1964) 79–94.
- MULSOW M., “Ambiguities of the Prisca Sapientia in Late Renaissance Humanism”, *Journal of The History of Ideas* 65/2 (2004) 1–13.
- , *Frühneuzeitliche Selbsterhaltung. Telesio und die Naturphilosophie der Renaissance* (Tübingen: 1998).
- OTERO-TORRES D.M., “Oliva Sabuco de Nantes y la construcción del estado: Nuevas topografías sociales e institucionales, feminismos, cuerpos escrituras” in I.M. Zavala (ed.), *La Página* (Tenerife: 2000) 67–85.
- , Romanos (eds.), *Lecturas críticas de textos hispánicos. Estudios de Literatura Española del Siglo de Oro* (Buenos Aires: 2000) 107–113.
- , “Texto femenino/autoridad masculina: Problemas de autoría en torno a La nueva filosofía de la naturaleza del hombre (1587) de Oliva Sabuco de Nantes”, in Calvo F.
- PARK K., “The Organic Soul”, in Schmitt C.B. – Skinner Q. (eds.), *The Cambridge History of Renaissance Philosophy* (Cambridge: 1988) 464–485.
- PERSIO ANTONIO, *Trattato dell'ingegno dell'huomo* (Venice, Aldo Manutio: 1576).
- PLATO, *Timaeus and Critias*, ed./tr. Lee D. (London: 1977).
- POMATA G., “Introduction”, in Oliva Sabuco de Nantes y Barrera, *The True Medicine*, ed./tr. Pomata G. (Toronto: 2010) 1–85.
- RIVERA-GARRETAS M.M., “Las prosistas del humanismo y del Renacimiento (1400–1550)” in Zavala I. (ed.), *Breve historia fememista de la literatura española (en lengua castellana)* (Barcelona: 1993) 83–131.
- , “Oliva Sabuco de Nantes Barrera” in Zavala I. (ed.), *Breve historia fememista de la literatura española (en lengua castellana)* (Barcelona: 1993) 131–147.
- SABUCO DE NANTES Y BARRERA OLIVA, *New Philosophy of Human Nature. Neither Known to Nor Attained by the Great Ancient Philosophers, which will improve Human Life and Health*: eds./trs. Waithe M.E. – Vintro M.C. – Zorita C.A. (Chicago: 2007).

- , *Nueva filosofía de la naturaleza del hombre, no conocida ni alcançada de los grandes filosofos antiguos. La qual mejora la vida y salud humana* (Madrid, Pedro Madrigal: 1588<sup>2</sup>).
- SCHUHMANN K., "Telesio's Concept of Matter" in *Atti del Convegno Internazionale di Studi su Bernadino Telesio* (Cosenza: 1990) 115–134.
- SIRAISSI N.G., *Medieval and Early Renaissance Medicine. An Introduction to Knowledge and Practice* (Chicago: 1990).
- SPRUIT L., *Species Intelligibilis. From Perception to Knowledge. Renaissance Controversies, Later Scholasticism and the Elimination of the Intelligible Species in Modern Philosophy* (Leiden-New York-Cologne: 1995).
- , "Telesio's Reform of the Philosophy of Mind", *Bruniana & Campanelliana* 3 (1997) 123–143.
- TELESIO BERNARDINO, *De rerum natura iuxta propria principia*: ed. Franco L. de, 2 vols. (Florence: 1980).
- , *La natura secondo i suoi principi*, con testo originale a fronte: ed./tr./intr. Bondì R. (Florence: 1999).
- WAITHE M.E., Oliva Sabuco de Nantes Barrera, in *A History of Women Philosophers, II: Medieval, Renaissance and Enlightenment Women Philosophers A.D. 500–1600* (Dordrecht-Boston-London: 1989) 261–284.
- WAITHE M.E. – VINTRO M.E., "Posthumously Plagiarizing Oliva Sabuco: An Appeal to Cataloging Librarians", *Cataloging & Classification Quarterly* 35, 3–4 (2003) 525–540.
- WALKER D.P., *Spiritual and Demonic Magic from Ficino to Campanella* (London: 1958).





“FULL OF RAPTURE”.  
MATERNAL VOCALITY AND MELANCHOLY IN  
WEBSTER’S *DUCHESS OF MALFI*

Marion A. Wells

*Summary*

In early modern medicine the pregnant woman becomes a particularly fraught example of bodily fusion partly because she seems to exemplify the vulnerability of one soul to another’s emotional perturbations: stories abound of women ‘imprinting’ their unborn children with the stigmata of their own unruly passions. I will argue in this paper that in *The Duchess of Malfi* Webster’s portrayal of the genesis of male melancholy within a story of transgressive pregnancy and child-birth provides the conditions for an exploration of the passions that complicates recent work on the humoralism of early modern psychology. Exploring the role of maternal voice as a powerful ‘spiritual’ catalyst for emotional perturbation, I will suggest that the maternal-foetal relationship acts as a model for a more broadly conceived view of what I call the *material relationality* of the passionate subject. Through its emphasis on the role of the imagination and the dynamic interplay between subjects in the development of melancholy, the play offers an account of melancholy as a complex psycho-physiological disorder not reducible to the role of black bile in the body.

*Introduction*

When Bosola, one of the characters in Webster’s *Duchess of Malfi* (ca. 1614), addresses himself to the origin of the tears that he unexpectedly produces at the death of the Duchess, he remarks: ‘This is manly sorrow: | These tears, I am very certain, never grew | In my mother’s milk’ (4, 2, 353). In Shakespeare’s *Henry V*, Exeter does attribute his tears to an irrepressible maternal influence, in terms that ruefully acknowledge rather than deny the impossibility of truly ‘manly sorrow’:

The pretty and sweet manner of it forced  
Those waters from me which I would have stopped.  
But I had not so much of man in me,

And all my mother came into mine eyes  
 And gave me up to tears.  
 (*Henry V*, 4, 6, 28–32)<sup>1</sup>

Both statements evoke the fungibility of maternal and filial bodies in early modern medical thought, suggesting not only the possibility of an emotional as well as physical connectedness between mother and child but also the seamless continuity between those two categories. Bosola's 'manly sorrow' is eventually identified as 'melancholy' – a diagnosis supported by the tears themselves, which were a recognised symptom of melancholy.<sup>2</sup> Like his employer, the Duchess's brother Duke Ferdinand, whose more florid displays of madness dominate the play, Bosola ends the play suffering from this most fashionable of early modern diseases.<sup>3</sup> In studying the play's treatment of the aetiology of melancholy in these men I will tease out the implications of Bosola's anxious resistance to the idea of maternal influence, suggesting that it dramatises not only Bosola's but also the play's ambivalence about the nature and origin of his melancholy – and of emotional perturbation more generally.<sup>4</sup>

<sup>1</sup> Gary Taylor offers a tellingly misleading note on this passage in his edition of *Henry V* (Oxford: 1982), suggesting that the 'unmanly loss of control' described here 'is probably related to *the mother* = hysteria'. The implications of this ahistorical slippage from the 'mother' (meaning 'womb') to the disease of *hysteria* are fully documented by Kaara Peterson in relation to similar notes on the well-known case of Lear's 'hysterica passio'. See n. 50 below.

<sup>2</sup> See Lange M., *Telling Tears in the English Renaissance* (Leiden: 1996), chapter 1, for a useful discussion of the medical linkages between tears and melancholy in early modern medicine.

<sup>3</sup> For a discussion of the fashionable nature of melancholy in this period, see Babb L., *The Elizabethan Malady. A Study of Melancholy in English from 1580–1642* (East Lansing: 1951) 3.

<sup>4</sup> The editors of the recent work *Reading the Early Modern Passions* acknowledge that 'the word emotion did not become a term for feeling until about 1660, around the time that 'individual' took on its modern meaning'; Paster G. – Rowe K. – Floyd-Wilson M. (eds.), *Reading the Early Modern Passions. Essays in the Cultural History of Emotion* (Philadelphia: 2004) 2. Thomas Dixon usefully cautions against using the terms 'passions' and 'emotions' interchangeably, but notes that Descartes' *Passions de l'âme* (1649) does seem to use the term 'émotions' as a fairly broad umbrella term for the movements of the soul, and may have influenced the Scottish philosophers' development of the term 'emotion'; Dixon T., *From Passions to Emotions. The Creation of a Secular Psychological Category* (Cambridge: 2003) 13. I am aware, then, of the terminological difficulties involved in talking about early modern passions, emotions, and 'psychological' states in general, particularly since what we think of as largely 'mental' states were irreducibly bound up with physical states in the medical writing of the period. But since I regard this period as working flexibly with a changing conception of mental states that draws on classical humoralism while moving inexorably towards what Jacques Bos sees as an increasing emphasis on 'individuality and

Bosola's negative evocation of a material connection between his tears and his mother's milk rests on the widely accepted view of a pneumatic system in which milk, sweat, tears, semen and other bodily fluids were interchangeably produced from concocted and aerated blood.<sup>5</sup> The fungibility of a maternal body in which menstrual blood is converted into breast-milk and then in grieving mothers into tears extends in Bosola's remark to the adult child, whose body experiences this fungibility vicariously. It is the very vicariousness – the quasi-figurativeness – of this 'psychological' fungibility that interests me. Bosola's statement clearly remains embedded in the humoral view of the early modern body so effectively described by Gail Kern Paster and other recent scholars; but it also gestures towards another view of emotional experience that emphasises not – or not primarily – the humoral condition of the individual body in the constitution of the emotions but rather the impact of external stimuli on the material physiology of the sensitive soul.<sup>6</sup> Taking my cue from the work of scholars like Jacques Bos, who argues that 'the humoralist model for the interpretation of mental phenomena began to disintegrate in the seventeenth century', I will argue that Webster's portrayal of the genesis of melancholy within a story of transgressive pregnancy and childbirth already provides the conditions for an exploration of the early modern passionate subject that is subtly different in emphasis from much recent discussion of the early modern emotions.<sup>7</sup>

---

transient passions,' I will cautiously use the term 'emotion' here to refer to what I see as Webster's exploration of an understanding of mental experience that is demonstrably not explicable solely in terms of humoral physiology. See Bos J., "The Rise and Decline of Character: Humoral Psychology in Ancient and Early Modern Medical Theory", *History of the Human Sciences* 22 (2009) 2.

<sup>5</sup> What we might call the 'pneumatic' body has been widely discussed in recent early modern scholarship, notably in Paster G., *The Body Embarrassed. Drama and the Disciplines of Shame in Early Modern England* (Ithaca: 1993) passim, but especially the introduction. Primary sources for this material would include for example Helkiah Crooke's *Mikrokosmographia. A Description of the Body of Man, together with the Controversies and Figures thereto Belonging/Collected and Translated out of all the best Authors of Anatomy, especially out of Gasper Bauhinus and Andreas Laurentius* (London, W. Iaggard: 1615) 174 which details the action of what he calls 'transpiration': the moving of the spirits around the body.

<sup>6</sup> For a discussion of the role of the sensitive soul in early modern theorising of the passions, see Solomon J.R., "You've Got to Have Soul: Understanding the Passions in Early Modern Culture", forthcoming in Pender S. – Struever N. (eds.), *Reasoning Effects. Rhetoric and Medicine in Early Modern Europe* (Aldershot: 2012) 25–26. I profit in my own essay from Solomon's detailed reorientation of her analysis of the passions away from an exclusive focus on the humours to include their various cognitive dimensions.

<sup>7</sup> Bos, "Rise and Decline of Character" 44.

A number of recent scholars, notably Gail Kern Paster and Michael Schoenfeldt, have fruitfully explored the humoral bases of early modern conceptualisations of what we now think of as psychological states (though of course it bears remarking that our 'psychological' categories have themselves recently been dominated by discoveries in brain chemistry).<sup>8</sup> In support of her argument for a humoral understanding of the emotions Paster approvingly quotes Charles Taylor's remark that 'melancholia is black bile . . . black bile doesn't just cause melancholy; melancholy somehow resides in it'.<sup>9</sup> But Taylor seems to be talking quite generally in this chapter about 'traditional' examples of mind-body relationship, rather than a specifically early modern understanding of melancholy. The humour of black bile certainly is constitutive of melancholy in the *locus classicus* for the study of the subject, the pseudo-Aristotelian *Problem* 30. But by the time Thomas Willis writes his *Two Discourses Concerning the Souls of Brutes* (1683), he is able to state unequivocally: 'we cannot here yield to what some Physicians affirm, that Melancholy doth arise from a Melancholick humor'.<sup>10</sup> Willis is in fact far more interested in the chemical nature of what he considers a 'distemper of the Brain and Spirits dwelling in it'.<sup>11</sup>

Michael Schoenfeldt also rightly sees the early modern passions as 'inextricably bound up with the humors'.<sup>12</sup> But while this mutual imbrication of passions and humours is undeniable in early modern writing, one of the writers to whom Schoenfeldt turns to exemplify this thesis, Thomas Wright, in fact frequently also suggests that it is the passions that promote the humours and are thus the primary instigators of emotional response.<sup>13</sup>

---

<sup>8</sup> See in particular Paster G., *Body Embarrassed*, and *Humoring the Body. Emotions and the Shakespearean Stage* (Chicago: 2004). As will become clear, I do suggest ways in which Paster's focus on the humoral nature of the emotions – though enormously productive for her readings of particular plays – may obscure the importance of other 'psychological' developments in this period. See also Schoenfeldt M., *Bodies and Selves in Early Modern England. Physiology and Inwardness in Spenser, Shakespeare, Herbert, and Milton* (Cambridge: 1999), and his recent essay on passion in Milton, "'Commotion Strange': Passion in *Paradise Lost*", in Paster – Floyd-Wilson, *Modern Passions* 43–68.

<sup>9</sup> Paster, *Humoring the Body* 5, quoting Taylor C., *The Sources of the Self. The Making of the Modern Identity* (Cambridge, Mass.: 1989) 188.

<sup>10</sup> Willis Thomas, *Two Discourses Concerning the Soul of Brutes. Which is that of the Vital and Sensitive Man* (1683); repr. Scholars' Facsimiles (Gainsville: 1971) 192.

<sup>11</sup> Willis, *Two Discourses* 191. See also Jackson S., "Melancholia and the Waning of the Humoral Theory", *Journal of the History of Medicine and Allied Sciences* 33 (1978) 367–376, for a discussion of the importance of Willis's work in this regard.

<sup>12</sup> Schoenfeldt, "Commotion Strange" 51.

<sup>13</sup> Wright Thomas, *The Passions of the Minde in Generall*, 1604. Reprint, ed. Newbold W. (New York: 1986). Hereafter I will refer to the Newbold edition.

According to Wright, the passions originate in the imagination, which activates the spirits to journey to the heart 'where they pitch at the door, signifying what an object was presented, convenient or inconvenient for it. The heart immediately bendeth either to prosecute it or to eschew it, and the better to effect that affection *draweth other humours to help him*; and so in pleasure concur great store of pure spirits; in pain and sadness, much melancholy blood' (italics mine).<sup>14</sup> As Julie Robin Solomon suggests, a purely humoral interpretation of Wright underplays the *cognitive* quality of the emotions clearly in evidence here.<sup>15</sup> Passions thus understood constitute a response to the world as it pertains to the subject herself: a judgment of whether a particular object is 'convenient or inconvenient'. The humours are still in play in this model, then, but they are activated by the pressure of the spirits from the brain, which are themselves drawn on by the *imagination* of what another doctor, William Vaughan, calls 'outward grief[s]' such as 'disgraces, iniuries, hatred, miserie, loss of honour,' and so on.<sup>16</sup> Juan Luis Vives writes similarly that 'our emotions seem to converge toward that part of the body where the fantasy prevails'.<sup>17</sup> Even that most Galenic of writers, Andreas Laurentius (*Discourse of the Preservation of Sight*, translated into English 1599), observes cautiously that the 'temperature of the body' is not everything: 'It is most true that Galen . . . in one whole booke maintaineth with strong and firme argument, that the maneres of the soule doe follow the temperature of the bodie [. . .] And yet I for my part wil not yeeld so much either to temperature or shape, as that they can altogether command and over-rule the soule'.<sup>18</sup> On the view I am uncovering here, then, the cognitively alive emotions first instigate psycho-physiological change by effecting material alterations in the body. Melancholy is (recognizably, to us) a physiological response to excessive

<sup>14</sup> Wright, *Passions of the Mind* 123.

<sup>15</sup> Solomon notes that Wright 'underlines their cognitive character [that is, of the emotions]' by situating them in the sensitive soul 'bordering upon reason and sense'. I also concur with her assessment that in spite of the apparent give and take between passions and humours noted in Wright by Schoenfeldt ("Commotion Strange" 51), 'Wright makes clear that for the most part, the passions of the soul impel the humors rather than the other way around'; Solomon, "You've Got to Have Soul" 25–26.

<sup>16</sup> Vaughan William, *Approved Directions for Health* (1612) 90.

<sup>17</sup> Vives Juan Luis, *The Passions of the Soul. The Third Book of De Anima et Vita*: ed. C. Norena, (Lewiston, NY: 1990), v. 4, 2. While acknowledging the continuing engagement of Vives and others with the humoral tradition, Noga Arikha aptly sums up the cognitive orientation of this work: 'Emotions, then, were ways of knowing the world'. Arikha N., *Passions and Tempers. A History of the Humours* (New York: 2007) 218.

<sup>18</sup> Laurentius Andreas, *A Discourse of the Preservation of Sight of Melancholike Diseases; of Rheumes, and of Old Age*: ed. Larkey S.V. (Oxford: 1938) 83.

sadness or fear (in respect of particular external objects or the appearance of such): 'when these affections are stirring in our minds they alter the humours of our bodies, causing some passion or alteration in them'.<sup>19</sup> Sadness is dangerous, Wright later tells us, because it causes 'the gathering together of much melancholy blood about the heart'.<sup>20</sup> But as Roy Porter has aptly emphasised, 'in discarding humoralism . . . physicians had no intention of setting mentalist theories in their place'.<sup>21</sup> In other words, even if the matter of the emotions turns out not to be primarily the humours, this does not suggest that psychology now rests on immaterial foundations. On the contrary, as we can see clearly in Thomas Willis's work, this psychology of the passions is still profoundly material in its dependence on the work of the animal spirits as the chemically reactive messengers between brain and praecordia.

The role of the imagination and its spiritual vehicles as the essential connective matter between outside objects and internal experience is underwritten by a theory of *inscription* or *imprinting*. Speaking of the force of visual apprehension of objects on the imagination, Wright explains: 'no sense *imprinteth* so firmly his forms in the imagination as this (*italics mine*)'.<sup>22</sup> Helkiah Crooke writes similarly: 'as the forming faculty in the heavens of those creatures whose generation is equivocall, is imprinted in the aer; after the same maner the formes of the Imagination are insculped or engraven in the aery spirits'.<sup>23</sup> In early modern medicine the 'insculping' power of a 'spiritual' object finds its most vivid, as well as its most troubling illustration in the example of foetal imprinting via maternal influence.<sup>24</sup> Crooke writes: 'Oftentimes the Imagination of that thing is imprinted in the tender Infant which the mother with childe doth ardently desire, which is onely to bee imputed to the strength of the Fancy. For the real species of a Figge or a Mulbery is not transported to the wombe, but onely the spirituall forme or abstracted notion'.<sup>25</sup> Though Wright does not use the language of imprinting to describe the convey-

<sup>19</sup> Wright, *Passions of the Mind* 94.

<sup>20</sup> Wright, *Passions of the Mind* 136.

<sup>21</sup> Porter R., "Barely Touching: A Social Perspective on Mind and Body", in Rousseau G.S. (ed.), *The Languages of Psyche. Mind and Body in Enlightenment Thought* (Berkeley-Los Angeles-Oxford: 1990) 57.

<sup>22</sup> Wright, *Passions of the Mind* 197.

<sup>23</sup> Crooke, *Mikrokosmographia* 312.

<sup>24</sup> See Bicks C., "Planned Parenthood: Minding the Quick Woman in *All's Well*", *Modern Philology* 103, 3 (2006) 305–306.

<sup>25</sup> Crooke, *Mikrokosmographia* 311.



ance of passion from mother to child, he describes the process in very similar terms:

It is wonderful what passionate appetites reign in women when they be with child; I have heard it credibly reported that there was a woman in Spain which longed almost till death to have a mouthful of flesh out of an extreme fat man's neck . . . most of these appetites proceed from women extremely addicted to follow their own desires, and of such a froward disposition as in very deed if they were crossed of their wills their Passions were so strong as they undoubtedly would miscarry of their children; for vehement Passions alter vehemently the temper and constitution of the body, which cannot but greatly prejudice the tender infant lying in the womb.<sup>26</sup>

That the long tradition of maternal/foetal influence is seeping into a developing mechanistic theory of the passions becomes quite clear in Descartes's striking rehearsal of this material in a letter to Marin Mersenne (July 30, 1640):

With reference to birth marks (Fr: 'marques d'envie'), since they never occur in the infant when the mother eats fruit which she likes, it is quite probable that they can sometimes be cured when the infant eats the fruit in question. For the same disposition which was in the mother's brain, and caused her desire, is also to be found in the infant's brain.<sup>27</sup>

Whereas Crooke seems to imagine the 'species' of the desired fruit as literally imprinted on the infant's body, Descartes understands the relevant issue here to be not so much the 'species' itself but the desire that informs it on the part of the imaginer (here the mother). The physical birth mark is of interest only, as the French phrase suggests, as a 'mark' of the mother's passion. In what follows I shall be suggesting that this conception of the infant mind's vulnerability to the material effects of her/his mother's bodily temper acts as a model for a much more broadly conceived view of what I shall call the *material relationality* of the early modern passionate subject, inwardly imprinted by transient stimuli but lacking any stable humoral essence.<sup>28</sup> In advancing this argument I will be seeking to complicate ongoing debates about the nature of early modern

<sup>26</sup> Wright, *Passions of the Mind* 145.

<sup>27</sup> Letter to Mersenne, 30 July 1640, in Cottingham J. – Stoothoff R. – Murdoch D. – Kenny A. (trs.), *The Philosophical Writings of Descartes, Vol. III, Correspondence* (Cambridge: 1991) 148.

<sup>28</sup> Solomon emphasises the point that early modern emotions are 'relational', arguing for an analysis of the passions that accounts for their active 'internal and external re-framing of perspective: 'You've Got to Have Soul' 49. This view tallies closely with the notion of 'material relationality' that I will develop in this essay. For a more detailed discussion

emotion by opening up the disparate and sometimes almost contradictory strains of thought apparent in such writers as Wright, Crooke, and Webster himself.

In this play in particular *maternal voice* becomes a powerful trigger for male fears about the kind of mutual dependency that pregnancy figures in this period but that is – *pace* the technical literature we have just surveyed – not confined to that unique mind-body composite.<sup>29</sup> I will henceforward use the term ‘vocality’ to denote the aspect of maternal voice that interests me here – the material, literal voice, or what Roland Barthes has called the ‘grain of the voice’.<sup>30</sup> For Barthes, Adriana Cavarero, and other recent theorists of the voice, the grain of the voice is ‘the materiality of the body speaking its mother tongue’.<sup>31</sup> This theoretical emphasis on materiality intersects with the early modern view of voice as a pneumatic flux that in writers like Helkiah Crooke is subtly connected in women to the womb and genitals. Following this train of thought in the medical literature allows me to explore more fully the significance of what I see in the play as a submerged connection between maternal vocality and male melancholy. Understood in this light, melancholy appears less a *sua sponte* product of humoral imbalance within a particular organism than as precisely an *emotion* as it would be fully theorised in the later mechanistic theories of writers like Descartes: an involuntarily occurring mental state produced by an interaction between the mind-body composite and a stimulating object or event in its environment.<sup>32</sup>

---

of the transition from humoral character to a focus on ‘transient passions’ of the mind see Bos, “Rise and Decline of Character” 29.

<sup>29</sup> I am adapting a term used by Susan James in her *Passion and Action. The Emotions in Seventeenth Century Philosophy* (Oxford: 1997) 42.

<sup>30</sup> Barthes R., *Image, Music, Text* (New York: 1977) 182.

<sup>31</sup> Barthes, *Image* 182. See also Cavarero A., *For More than One Voice. Toward a Philosophy of Vocal Expression*: tr./intr. Kottman P.A. (Stanford: 2005). As she acknowledges, Cavarero is herself indebted for her materialist conception of voice to Julia Kristeva’s notion of the ‘semiotic processes’ which are largely pre-semantic and remain closely associated with the rhythms of the mother’s body. See for instance Kristeva’s discussion of the semiotic and language in Kristeva J., *Black Sun. Depression and Melancholia* (New York: 1989) 68. This notion of a pre-semantic or semiotic vocality will be useful for my later development of the impact of maternal vocality on the child.

<sup>32</sup> See Dixon’s discussion of the emergence of emotion language, particularly *From Passion to Emotion* chs. 1 and 4. Solomon also discusses this aspect of the emotions, arguing that ‘passion involved responsive activity, and action was in large measure dependent on the nature of human responsiveness to environment’ (Solomon, “You’ve Got to Have Soul” 11). Emphasising the continuity between Descartes and earlier theorists of the passions, Bos writes: ‘In essence, Descartes’s psychology of the passions is a mechanistic psychology that eventually explains emotional states by connecting them with the *physical processing of external impressions* (italics mine)’ (Bos, “Rise and Decline of Character” 41).

*All in the Mind. The Instability of Mental Experience*

The notion of Bosola's ongoing emotional subjection to a now absent maternal influence seems connected to his claim after the Duchess's death that he continues to feel her acting upon him: 'Still methinks the Duchess | Haunts me; there, there: | *'Tis nothing but my melancholy*' (5, 2, 340–342, italics mine). The relatively new meaning of 'haunt' to describe a spirit returning to its former home (OED 5b, 1590) suggests intriguingly that the Duchess's death has intensified the play's fantasy of the passionate subject as penetrated by alien spirits – in particular, of course, by the spirits of the ever-present maternal body. A roughly contemporary meaning of 'haunt' is 'to visit frequently or habitually, of diseases, memories etc.,' (OED). To be *haunted* in this play is to feel a rising in oneself of involuntary passions – spirits – that respond to emotional stimuli *from elsewhere* and seem uncannily both *other* and internal.

As I have suggested, the paradigmatic condition of subjection is the dependence of the foetus on maternal appetites and imaginings. Ferdinand's reaction to the news that the secretly married Duchess has had three children by her husband suggests just how deeply unsettling is the prospect of such dependence:

Damn her! That body of hers,  
 While that my blood ran pure in't, was more worth  
 Than that which thou wouldst comfort, called a soul.  
 (4, 1, 121–124, italics mine)

Though of course Ferdinand is ostensibly referring here to the adulteration of the Aragon bloodline through his sister's choice of her steward as a husband, the figurative placement of *his* blood in *her* body clearly suggests a sense in which Ferdinand considers his own physical wellbeing to be as dependent on her body's blood as that of the child whose existence he has just discovered. Strikingly, it is Ferdinand's *imagination* of his sister's sexual 'sin' that first provokes the condition that the play will call melancholia:

Methinks I see her laughing,  
 Excellent hyena! Talk to me somewhat, quickly,  
 Or my imagination will carry me  
 To see her in the shameful act of sin.  
 (2, 5, 38–40, italics mine)

'With whom?' the less viscerally disturbed Cardinal asks. Ferdinand's vivid evocation of the man who 'leaps [his] sister' as 'some strong thighed barge-man, | Or one o'th'wood-yard, that can quoit the sledge . . . or else some

lovely squire | That carries coals up to her privy lodgings' (2, 5, 43–45), confirms the scene's interest in portraying the overmastering power of the imagination. Charged with 'fly[ing] beyond reason' by his brother the Cardinal, Ferdinand responds tellingly: 'Go to, mistress! 'Tis not your whore's milk that shall quench my wild-fire, | But your whore's blood' (2, 5, 46–48). Ferdinand here responds directly to the Duchess, who is not present, rather than to the Cardinal, who is; moreover, he constructs his imaginary sister as a maternal figure, one whose 'whore's milk' will return in his violent fantasy to its original identity as blood. Lost in a scene of his own imagining, Ferdinand succumbs to a mental state the Cardinal aptly terms a 'rupture' ('I can be angry | Without this rupture,' 2, 5, 55–56).

The duke's mental 'rupture' certainly dramatises quite clearly the activity of the imagination in generating the passions that we saw earlier in Wright's description of the spirits 'pitch[ing] at the door of the heart'.<sup>33</sup> But the genesis of Ferdinand's melancholy is interestingly underdiagnosed by the play's physician, who relies on comfortably conventional humoral interpretations of his sickness. The doctor confidently diagnoses Ferdinand's disease as lycanthropy, a form of melancholy:

In those that are possessed with't there o'erflows  
Such melancholy humour, they imagine  
Themselves to be transformed into wolves,  
Steal forth to churchyards in the dead of night . . .  
[...]  
Straight I was sent for,  
And having ministered to him, found his grace  
Very well recovered.  
(5, 2, 9–21)

The doctor's complacent assertion that the problem is an overflow of melancholy humour that can be easily treated (presumably with traditional remedies, such as blood-letting) is scarcely well founded. For Ferdinand is not very well recovered, and his fascination with churchyards, as the audience knows but the doctor does not, coincides with his passionate rage and jealousy towards his sister and his subsequent murder of her. This brief scene with the doctor seems to serve little purpose other than to emphasise the possibility of a *psychological* reading of Ferdinand's melancholy. Such a reading would not of course obviate the need to read his 'passions' in psycho-*somatic* terms, nor would it exclude the role of the

---

<sup>33</sup> Wright, *Passions of the Mind* 123.

humours altogether, but it does give greater emphasis to a dynamic view of the passions as unpredictable inter-subjective events that cannot be reduced to humoral excess.

*'Sure I Did Hear a Woman Shriek'.  
Melancholy and the Maternal Voice*

As we have seen, the central issue in this emerging conception of what will eventually be called the emotions is the volatility of transient passions – a volatility partly attributed to the impact of the environment on the impressionable spirits operative in the vehicles of the sensitive soul. Since *voice* was also usually understood to participate in the circulation of aerated spirit and to act as a vehicle for conveying outward what Aristotle terms 'sound characteristic of what has soul in it' and 'sound with meaning (*phonê semantikê*)' (*On the Soul* 420b6; 420b34), the voice emerges as a kind of *via media* between the internal and external worlds.<sup>34</sup> As such it could have an impact on the body's spiritual health (Crooke and Richard Mulcaster both mention vocalisation exercises that promote health) and also on the surrounding environment itself. Thus Gertrude pleads with Hamlet to refrain from further speech: 'These words, like daggers, enter in mine ears. | No more, sweet Hamlet!' (3, 4, 96). The spiritual nature of voice is confirmed by later writers like Agrippa von Nettesheim in his *Three Books of Occult Philosophy* (translated into English in 1651), 'voyce is sent forth out of the inward cavity of the breast and heart, by the assistance of the spirit'; the spoken word is 'a spirit proceeding out of the mouth with sound and voice, signifying something'.<sup>35</sup>

Helkiah Crooke's compendious 1615 *Mikrokosmographia* considers the voice to be thoroughly enmeshed in the functioning of the whole body, and responsive in particular to changes in the sexual organs. Having previously noted that the removal of the breasts in women produces a shriller

<sup>34</sup> See Bonnie Gorden's recent work on the implication of voice in the pneumatic system of body and soul: 'the parallel substances of voice, tears, vomit, and sweat turned into one another and flowed in and out of the body through open orifices, purifying, nourishing, and flushing it', *Monteverdi's Unruly Women. The Power of Song in Early Modern Italy* (Cambridge: 2004) 20. See also the extensive discussion of the materiality of voice in Bloom G., *Voice in Motion. Staging Gender, Shaping Sound in Early Modern England* (Philadelphia: 2007), especially chapter 2, 'Words made of breath'.

<sup>35</sup> Agrippa von Nettesheim, *Three Books of Occult Philosophy* (tr. 1651) 3,36. See Bloom, *Voice in Motion* 81 for a discussion of Agrippa's theory.

voice, he adds: 'when the testicles doe swell upon a cough, it putteth us in mind of a sympathy and consent there is between the chest, the paps, the seede, and the voice. And how great the consent is betwixt the parts of respiration and the parts of generation'.<sup>36</sup> This 'sympathy and consent' between mouth/throat and the reproductive organs can be traced back to the Hippocratic corpus where, as Ann Hanson and David Armstrong put it, 'the two necks [i.e., neck and cervix] are coupled'.<sup>37</sup> As a result of this material sympathy, a change in either neck or voice may indicate loss of virginity. The most striking example of this association among the sources excavated by Hanson and Armstrong is Nemesianus's *Eclogue* 2, which describes the shepherdess Donace's post-coital voice as less delicate than before ('non tam tenui filo'), disturbed and rich ('sollicitusque . . . pinguis') Since 'pinguis' can also mean 'rich' in the sense of 'fertile,' this language clearly implies that the voice betrays in its timbre a kind of bodily sexualisation.<sup>38</sup>

Helkiah Crooke extends the analogic connection between mouth and womb in his evocation of the womb as 'greedy': 'And presently after the seeds are thus mingled, the womb [...] gathereth and contracteth it selfe, . . . And this it doth as being greedy to conteyne and to cherish, we say to Conceiue the seed. Moreover, least the geniture thus layd vp should issue forth againe, the *mouth or orifice of the wombe* is so exquisitly shut and locked vp that it will not admit the poynt of a needle' (italics mine).<sup>39</sup> The secretly pregnant Duchess herself helps to confirm the relationship between mouth and womb, gluttony and pregnancy, remarking to Antonio in the notorious 'apricocks' scene: 'do I not grow fat?' (2, 1, 101). (Fat here seems to have exactly the same valence as the Latin 'pinguis'.) By the same token, when she eagerly ingests the apricots offered her by Bosola, this 'taking in' seems to activate the primary sexual meaning of the euphemistic Greek expression 'to take into the belly'.<sup>40</sup> The line 'How they swell me!' therefore suggests not only that the green apricots have swollen her belly through indigestion but also that they signify the male seed that has

<sup>36</sup> Crooke, *Mikrokosmographia* 160 (on the breasts); 207 (on consent between the chest, etc.).

<sup>37</sup> Armstrong D. – Hanson A., "The Virgin's Voice and Neck: Aeschylus, *Agamemnon* 245 and Other Texts", *Bulletin of the Institute of Classical Studies* 33 (1986) 99.

<sup>38</sup> Armstrong – Hanson, "The Virgin's Voice and Neck" 98.

<sup>39</sup> Crooke, *Mikrokosmographia* 262.

<sup>40</sup> Following Emile Benveniste, Giulia Sissa points out that 'the classical Greek words for pregnancy were *en gastri lambanein*, *syllambanein*, *echein* (to take, embrace, or have in the stomach)'. See Sissa G., *Greek Virginity*: tr. Goldhammer A. (Cambridge, Mass.: 1990) 63.

impregnated – that is, *swollen* – her. When Bosola muses afterwards that ‘there is no question but her . . . most vulturous eating of the apricots [is] an apparent sign of breeding’ (2, 2, 2), we realise we have participated in a voyeuristic dumb-show, a dramatisation of the action of the ‘greedy’ womb at conception through the upwardly displaced symbolism of the greedy mouth. Moreover, the emphasis on the greed with which she eats the apricots (‘how greedily she eats them!’ Bosola remarks aside at 2, 1, 140) recalls Wright’s moralistic discussion of the ‘passionate appetites’ of pregnant women. Like the woman in Wright’s apocryphal story who desired ‘to have a mouthful of flesh out of an extreme fat man’s neck,’ the Duchess reveals here not only her ‘greedy’ appetite for a base food (the apricots have been ripened in horse dung), but also what Wright calls a ‘froward disposition’; if she can be overcome by such an appetite, the reasoning goes, she will be overcome by other ‘vehement Passions’ and ‘prejudice’ the infant in her womb accordingly.

Just as taking food in through the ‘vulturous’ mouth can suddenly appear to be a dramatisation of the greedy womb’s absorption of seed, so the analogy extends upwards, figuring the production of voice from the body as a kind of birth. Thus Crooke writes that ‘the voice was prepared in the rough arterie when the aire being shut up and compressed there, *doth after a sort attaine the state and condition of a solid bodie before it yssue through the cleft*, and being extruded or thrust out with violence and force through the strait cleft, yeeldeth that sound which we call a Voice’ (italics mine).<sup>41</sup> The voice of a pregnant woman, then, would presumably have brought to mind with particular force the supposed consent between the ‘organs of respiration and the organs of generation,’ perhaps to suggest something more than mere analogy: a literal, material connection between what Agrippa calls the ‘vivified aire’ of the voice and the mysterious process of conception. This intuition finds intriguing support in a passing moment in Middleton’s *Women Beware Women* (ca. 1621). In this play the heroine of the subplot, Isabella, has engaged in an incestuous liaison with her uncle Hippolito even as she is ‘tendered’ as a bride to the witless Ward. One of the qualities her father praises in her as he shows her off is her ‘breast,’ here meaning ‘voice’ but also the physical breast – a bawdy pun that perhaps alludes to the medical conception of the ‘consent’ between voice and the sexual organs. Later, when her adultery is revealed by her pregnancy, the Ward remarks:

---

<sup>41</sup> Crooke, *Mikrokosmographia* 646.



Her father praised her breast, sh'ad the voice, forsooth; I marvelled she sung  
so small indeed, being no maid. Now I perceive there's a young chorister in  
her belly – this breeds a singing in my head, I'm sure.  
(4, 2, 116–119)

Although William Carroll notes in his edition to the play that 'maid' here means 'young girl,' the passage in fact seems to be an early modern instance of the notion that a woman's voice changed after she had sex.<sup>42</sup> The passage also clearly suggests that pregnancy alters the voice by humorously asserting that it is the baby itself (the young chorister) whose voice sings through its mother's 'breast'. Since Middleton did use young choristers to perform his plays these lines also draw attention to the fact that there *is* a young boy inside Isabella's costume, playing Isabella herself; her voice *is* a boy's voice mimicking a woman's. The cross-dressed boy actor playing a pregnant woman conveys through his voice the fusion of mother and male child that becomes such a powerful catalyst for discussions of emotion. Not coincidentally, this maternal/childish voice produces ('breeds') in the male listener 'a singing in [the] head' – a kind of dizzying unease that in the less comic context of Webster's play will progress into melancholy.

Early modern writers seem quite aware of the mutual imbrication of maternal vocality and the physical aspects of maternal nurturance. In his *View of the Present State of Ireland* Spenser remarks: "The child that sucketh the milk of the nurse must of necessity learn his first speech of her, the which being the first that is inured of his tongue, is ever after the most pleasing unto him".<sup>43</sup> The intimacy of this first linguistic relation is intensified if we consider that not only does the dependent *infans* receive the mother-tongue along with maternal milk in an almost indistinguishable flow from outside to inside, she or he also hears from within a space filled with what Crooke calls *inbred air* derived from the 'purest ayry part of the mother's blood' within the womb.<sup>44</sup> The division between outside and

<sup>42</sup> Middleton Thomas, *Women Beware Women*: ed. Carroll W.C. (London: 1994).

<sup>43</sup> Spenser Edmund, *View of the Present State of Ireland*: ed. Renwick W.L. (Oxford: 1970) 68. See Julie Costello's interesting discussion of this text in the context of early colonialism, "Maria Edgeworth and the Politics of Consumption: Eating, Breastfeeding, and the Irish Wet Nurse in *Ennu*", in Greenfield S. – Barash C. (eds.), *Inventing Maternity. Politics, Science, and Literature, 1650–1865* (Lexington KY: 1999) 180. See also Wendy Wall's interesting discussion of Spenser's text as an instance of early modern views of the transmission of culture within potentially disruptive domestic contexts, in *Staging Domesticity. Household Work and English Identity in Early Modern Drama* (Cambridge: 2002) 136.

<sup>44</sup> Crooke's discussion of 'inbred air' occurs in *Mikrokosmographia* 607.

inside is tenuous indeed. Writing in praise of women in his *Haec Homo* of 1637, William Austin observes this intimacy in an ostensibly positive light: 'For from their voyce (the voice of women, and particularly mothers) men learne to frame their owne, to be understood of others. For in our infancy, we learne our language from them. Which men (therein not ingratefull) have justly termed our *Mother tongue*'.<sup>45</sup> But there is room for ambivalence in an earlier passage in which he writes: 'men also (while they are in their child-hood and infancy . . .) are voiced like women'.<sup>46</sup> Being 'voiced like [a woman]' surely carries a more ambiguous charge than this author admits, not least because it suggests an unaltered dependency on both the maternal tongue and the nourishing maternal body.

As the passage in Middleton's play suggests, the notion that a boy is 'voiced like a woman' is especially relevant in the context of a theatrical practice that gives women's parts to boys. Though I do not have space here to explore fully the significance of the fact that the Duchess's lines would have been spoken by a boy, it will be helpful to remember that audiences would have heard, as Bruce Smith reminds us, 'sounds in the same pitch range as an adult female voice, but more carrying and penetrating'.<sup>47</sup> Like a woman, speaking as it were the 'mother-tongue,' and yet not quite a woman; the ambiguous and even contradictory signals conveyed by the pitch and harmonics of the actor's voice would surely have served to intensify the audience's awareness of precisely the kind of embodied relationality that finds its most powerful model in the pregnant body.

From the first the Duchess's verbal prowess seems to generate a series of scenes that explore the impact of her voice on the emotions of the male hearer – culminating of course in the uncanny Echo scene. These scenes promote a complex association between powerful female speech, pregnancy, and maternal influence; Bosola, Antonio, and Duke Ferdinand all manifest emotional disturbance as a literal, bodily haunting by the mother as a kind of vocalic spirit. The crisis that brings into the open the mutual imbrication of these discrete threads is the moment of childbirth, overheard (in the Duchess's cries of pain) but not witnessed by her male

<sup>45</sup> Austin William, *Haec Homo. Wherein the Excellency of the Creation of Woman is Described* (London, Richard Olton: 1637) 133. See Linda Phyllis Austern's interesting discussion of this text in the context of a discussion of the mother's voice: " 'My Mother Musicke': Music and Early Modern Fantasies of Embodiment" in Miller N. – Yavneh N. (eds.), *Maternal Measures. Figuring Caregivers in the Early Modern Period* (Aldershot: 2000) 243–244.

<sup>46</sup> Austin, *Haec Homo* 126.

<sup>47</sup> Smith B., *The Acoustic World of Early Modern England. Attending to the O-Factor* (Chicago: 1999) 229.

companions. Her shriek – vocal sign of the ‘swollen’ belly – derails both her hearers physically and emotionally in ways that precipitate the play’s tragic denouement.

The first detail we hear of the Duchess from Antonio concerns her speech: ‘For her discourse, it is so full of rapture, | You will only begin then to be sorry | When she doth end her speech’ (1, 1, 181–182). Rapture suggests a seizure of the self, a ‘raptus’ that might be desired or wholly undesirable; the O.E.D. suggests ‘a state of passion’ (1d) or ‘a strong fit or paroxysm of (some emotion or mental state)’ (1e), as well as ‘the action of carrying a woman off by force’ (2a). The Latin root of ‘rapture,’ *rapere*, ‘to carry off,’ attests to the potentially dangerous power of such a voice; it suggests indeed that it possesses a kind of emasculating force with the power to carry Antonio off as it were *from the inside*.<sup>48</sup> We might associate such power with the psychological ‘rupture’ suffered by Ferdinand when he hears of the Duchess’s pregnancy – in both cases the play highlights her power to intervene powerfully in the inward experience of these men. In the wooing scene the Duchess dramatises this power of ‘rapture’ by seizing Antonio with her words and placing him in the role of husband. Boldly initiating the words of the *de praesenti* spousal ceremony she ushers him into this role – though it is worth noting that he never really answers her in kind, as the *de praesenti* vow requires him to do:

Awake, awake, man.  
I do here put off all vain ceremony,  
And only do appear to you a young widow  
that claims you for her husband, and like a widow  
I use but half a blush in’t.  
(1, 1, 445–448)

Though he does not demur, Antonio does tellingly remark a few lines later: ‘These words should be mine, | And all the parts you have spoke’ (1, 1, 462). In spite of the passion of the scene there remains something of the maternal in the Duchess’s teasing encouragement of her lover. She compares him as he receives her kiss to a child receiving a treat: ‘This you should have begged now. | I have seen children oft eat sweetmeats thus, | As fearful to devour them too soon’ (455–458). Although Antonio dutifully receives his ‘nourishment’ in this scene, he is notably tight-lipped in the

---

<sup>48</sup> See Deborah Burks’s excellent discussion of the relationship between ‘rapture’ and ‘raptus’ (rape), in Burks D., “‘I’ll want my Will Else’: The Changeling and Women’s Complicity with their Rapists”, *English Literary History* 62, 4 (1995) 769–770.

apricocks scene, refusing the Duchess's offer to share the apricots with a prim 'Indeed, madam, I do not love the fruit' (2, 1, 133–134).<sup>49</sup>

Earlier in that scene the Duchess interestingly invokes the disease of the 'mother' (a form of suffocation or hysterical disease attributed mostly to widows and unmarried girls, and thought to be caused by the rising of noxious vapours from the womb into other organs): 'I am | So troubled with the mother' (2, 1, 110).<sup>50</sup> The symptoms singled out in Edward Jorden's 1603 treatise *The Suffocation of the Mother* suggest how routinely disorders of the womb were implicated in digestive, vocalic and respiratory symptoms including 'gnawing in the stomach . . . vomiting, loathing of meate . . . swelling in the throat, *privation of voice*, rumbling and noise in the belly or throat' (italics mine).<sup>51</sup> By the end of the scene the Duchess is truly in the grip of the kind of mother-fit described by Jorden as a precursor to labour. Her speech conveys the bodily discomfort she is experiencing, and indicates that she will soon be overtaken by the 'privation of voice' mentioned as a symptom by Jorden: 'O, I am in an extreme cold sweat!' (2, 1, 148). 'O good Antonio, I fear I am undone' (2, 1, 151–152). The Duchess's sudden 'mother-fit' suggests that she has herself been 'rapt' by the mysterious workings of the mother (womb), which overtakes even her ability to speak. The connection between her internal trouble

<sup>49</sup> See Wendy Wall for a reading of this moment in connection with the Duchess's later concern about providing syrup for her child, "Just a Spoonful of Sugar: Syrup and Domesticity in Early Modern England", *Modern Philology* 104, 2 (2006) 159.

<sup>50</sup> Helen King has shown in detail that the connection between the womb (*hustera*) and 'hysteria' as it later developed is by no means straightforward in the Hippocratic account often adduced as the source of the later tradition. She writes: 'in the ancient period the word "hysteria" is not used at all; *husterikos*, "hysteric", is used, but with the very specific meanings coming from the womb/suffering due to the womb'. "Once Upon a Text: Hysteria from Hippocrates" 11, in Gilman S. – King H. – Porter R. – Rousseau G.S. – Showalter E. (eds.), *Hysteria Beyond Freud* (Berkeley-Los Angeles-Oxford: 1993) 3–91. Edward Jorden's work is rather Hippocratic in its localisation in the womb of the disease that he calls primarily 'suffocation of the mother' – for him its alternate names include 'passio hysterica' and 'strangulatus uteri'. The immense disruptive power he attributes to the womb arises largely from the 'community and consent' he considers it to have 'with the braine, heart, and liver, the principall seates of these functions [i.e., animal, vital, and natural functions]. And hereupon the symptoms of this disease [suffocation of the mother, or womb] are sayd to be monstrous and terrible to beholde, and of such varietie as they can hardly be comprehended within any method or boundes'. Jorden Edward, *Disease of the Suffocation of the Mother* (London: 1603), ed. Macdonald M. (New York: 1991) 2. Weighing in on the subject of historical mis-readings of "hysterica passio" in terms of much later (and vaguer) conceptions of hysteria, Kaara Peterson offers a compelling reading of that term's significance in *King Lear*: "Historica Passio: Early Modern Medicine, King Lear, and Editorial Practice", *Shakespeare Quarterly* 57, 1 (2006) 1–22.

<sup>51</sup> Jorden, *Suffocation* 18.

and the 'rapture' attributed to her voice finds suggestive support in Webster's similar formulation in a later play. In *The Devil's Law-Case* (ca. 1619), Leonora, a powerful widowed woman and mother of two of the central characters, has secretly fallen in love with one of her daughter's suitors, Contrarino. When she hears that her son Romelio has killed him, she says: 'I am very sick'. Her son replies: 'Your old disease: when you are grieved, you are troubled | With the mother'. Leonora then tellingly replies: 'I am rapt with the mother indeed | That I ever bore such a son' (3, 3, 225–229). This exchange suggests how readily overwhelming emotion is associated with the disease of the 'mother' or womb, and then with the figure of the mother herself. If we read this form of 'rapture' back into the scene of the Duchess's confinement, we might suspect that the Duchess's power to *enrapture* her hearers is metonymically associated with her maternal influence precisely through the disabling emotional power attributed to the 'mother'/womb.

The next vocalisation we hear from the Duchess is indeed not a word at all, but rather a shriek, presumably as she gives birth offstage. Bosola is drawn to her chamber by the sound: 'Sure I did hear a woman shriek: list, ha? . . . List again! | It may be 'twas the melancholy bird . . . The owl, that screamed so' (2, 3, 1–8). The passing reference to the 'melancholy bird, the owl' hints at the play's interest in the *emotive* power of this maternal shriek. Like the scene in Middleton's play, though this time in a tragic vein, the mother's voice has the power to 'breed a singing' in the brain of the male hearer. Bosola is joined by Antonio, and both men move towards the source of the sound as in a kind of trance: 'Let's walk towards it. | No: it may be 'twas | But the rising of the wind' (2, 3, 16–17). Her voice has faded to something that is both more and less than voice: it is no longer Aristotle's *phonê semantikê*, a sound with meaning, unless that meaning be beyond the subject's control, the speech of the body; it is pure *pneuma*, the 'aery' spirit itself. If, as Bruce Smith argues, 'speech sounds [in the early modern theatre] gendered as male would pervade the wooden O, filling it from side to side,' and 'speech sounds gendered as female would be heard as isolated effects within this male matrix,' we seem to experience in this moment a reversal of the usual acoustic structure.<sup>52</sup> What Smith calls the 'male matrix' of sound has become female, as the two disoriented men wander in a space filled with a female sound of ambiguous provenance and meaning. This reversal then dramatises an enclosure of

<sup>52</sup> Smith, *Acoustic World* 229.

the male voice by the female one – just as the ‘young chorister’ is enclosed by ‘Isabella’s maternal body in Middleton’s play. But whereas Isabella is still able to control the semantic content of her voice – through her witty singing about her miserable marriage – the Duchess’s voice expresses what Bruce Smith calls the ‘O factor’: ‘From the very beginning [...] a child uses sound as a way of projecting its body, its *self*, into the space around it. [O] is a primal cry, and we never forget its bodily trace.’<sup>53</sup> The Duchess’s repeated ‘O’s, and especially her later shriek, bear witness to a body exerting an irresistible power over the normally highly cognitive activity of speech, obliterating its semantic content, the *logos* itself.

That this obliteration of *logos* by a primal cry poses a very material threat to the masculine world of the court is suggested by the startling piece of stage business with Antonio’s handkerchief. After a verbal duel with Bosola Antonio suddenly remarks aside:

My nose bleeds. [He draws an initialed handkerchief]

One that were superstitious would count  
This ominous, when it merely comes by chance:  
Two letters, that are wrought here for my name,  
Are drowned in blood!  
(2, 3, 43–46)

The timing of Antonio’s nosebleed suggests that it is provoked by the Duchess’s shriek of pain. Acting, then, as a displaced version of the blood from the birthing scene to which we have aural but not visual access, the blood from Antonio’s nose ‘drowns’ out the letters of his name in a symbolic reiteration of the drowning out of ‘*logos*’ by the shriek itself. Activated by the spiritually disturbing shriek, Antonio’s own blood flows in response to his wife’s pain, just as the Ward’s head ‘sings’ in horrified response to the voice of the ‘young chorister’ in Isabella’s belly. The symbolic import of this striking moment seems to be that Antonio momentarily loses his own separate identity under the sway of the violent emotion conveyed to him through his wife’s shriek. His blood flows involuntarily, just as Exeter’s ‘mother came into [his] eyes | And gave [him] up to tears’ (*Henry V* 4, 6, 30–32). Since in this period a nosebleed was linked to menstruation (either as a form of ‘vicarious’ menstruation or as a symptom of menstrual disorder), Antonio does indeed seem to be (like his wife) ‘rapt with the mother’ in this scene: not initially because of humoral disturbance, but

---

<sup>53</sup> Smith, *Acoustic World* 13.

because of an irrepressible bodily reaction to a passionate disturbance of the mind.<sup>54</sup>

When Bosola subsequently finds the horoscope Antonio has dropped, and by this means discovers the cause of the Duchess's confinement, he plans to send a letter to 'make her brothers' galls | O'erflow their livers' (2, 3, 74–75). The letter seems to encode the shriek of childbirth and in so doing makes Ferdinand's liver 'o'erflow', just as Antonio's nose overflows with blood and 'drowns' the initials of his name. The plethoric maternal body in childbirth is isolated from the view of men but its voice cannot be silenced. As though to confirm the connection between the handkerchief drowned in blood and the letter Ferdinand receives, Ferdinand refers to his letter as a 'mandrake' he has 'this night digged up' (2, 5, 1). According to medieval lore, the mandrake shrieked when it was dug up, posing the threat of death or madness to the one who heard it (thus Shakespeare's Juliet refers to 'shrieks like mandrakes torn out of the earth, | That living mortals, hearing them, run mad' (3, 47–48)). The letter, then, conveys a displaced version of the Duchess's shriek which, like that of a mandrake, will make him mad (or melancholy, in this case). This shriek causes him, in a striking repetition of Antonio's action, to draw his handkerchief and soil it with the tears that he quickly imagines replaced by blood – the Duchess's own: 'There is a kind of pity in mine eye, | I'll give it to my handkercher; and now 'tis here, | I'll bequeath this to her bastard . . . to make soft lint for his mother's wounds' (2, 5, 26–30). Since the mandrake was also associated with fertility and thus with childbirth, its shriek in this context is doubly significant. It is the sign of a fertility that kills, or makes mad; as a shriek it signifies a pre-semantic vocality that 'drowns' the letters that would organise identity by recalling in the listener a (now irredeemably lost) relation to, and dependency on, the maternal body.<sup>55</sup> Thus although Bosola and the doctor speak in terms of an overflow of humours (gall and melancholy), it is Ferdinand's outraged imagination of 'her in the shameful act of sin' that 'carr[ies]' him remorselessly towards the mental 'rupture' that he experiences in this scene.

<sup>54</sup> Peggy McCracken's fascinating account of the cultural value of blood touches on the function of the nosebleed (in relation to Guinevere's claim that her sheets are stained with blood from her nose in Chrétien's *Lancelot*). She writes: 'The analogy between a nosebleed and menstruation is surely motivated by the fact that both are characterized by an uncontrolled flow of blood that does not result from a wound or a disease'. *The Curse of Eve, The Wound of the Hero. Blood, Gender, and Medieval Literature* (Philadelphia: 2003) 13.

<sup>55</sup> See n. 31 above.



In light of this analysis we are not surprised to find in Ferdinand's encounter with the Duchess in her closet an attempt primarily not to kill but to *silence* her. The closet scene is the clearest dramatisation thus far in the play of what Adriana Cavarero sees as the primary meaning of voice: invocation, a calling to the other. For Cavarero, the primary model for such invocation is the mother-child dyad: '[the voice's] inaugural scene coincides with birth, where the infant, with her first breath, invokes a voice in response, appeals to an ear to receive her cry, convokes another voice . . . the voice first of all signifies itself, nothing other than the relationality of the vocalic'.<sup>56</sup> Before Ferdinand's intrusion, this scene provides an idyllic version of vocalic relationality; the Duchess and Antonio enjoy what sounds like a highly pleasurable back and forth that has prompted numerous critics to read the scene as part of an emerging discovery of bourgeois companionate marriage. But Antonio withdraws, leaving Ferdinand to step into the space of invocation as his more vengeful double. 'Do not speak' (3, 2, 74), he commands, refusing her desperate plea to be heard: 'Pray sir, hear me' (3, 2, 73). When the Duchess does try to speak, Ferdinand replies: 'The howling of a wolf | Is music to thee, screech-owl; prithee peace' (3, 2, 88). She is still compared to non-human creatures: the wolf, and the owl, the melancholy bird to whose screech Bosola has earlier compared her shriek.

Kaara Peterson has suggested that the Duchess's death by strangulation mimics the disease of the 'mother,' sometimes also referred to as 'strangulatus uteri': she is punished, in other words, for being, as Bosola remarks aside, 'too much' troubled with the mother, or too driven by her sexuality.<sup>57</sup> I would add to this that the significance of this strangulation lies in its rendering permanent the temporary symptom of 'privation of voice,' its destruction of her power to *invoke* a response in a male listener. The early modern insistence on a pneumatic consent between mouth, throat, and reproductive organs gives a special materiality to this invocatory power, and helps to explain the return of this voice as an echoic 'spirit that answers' in the Echo scene.

<sup>56</sup> Cavarero, *For More than One Voice* 169.

<sup>57</sup> Peterson K., "Shakespearean Revivifications: Early Modern Undead" *Shakespeare Studies* 32 (2004) 240–266, 262–263.

*'Thou Art a Dead Thing'. Echo and the Passions of the Mind*

Eccho to the Painter, out of Ausonius

Alas! fond Painter, why dost strive to grace  
 An unknown Goddess with a fancy'd Face?  
 I am the Daughter of the Tongue, and Wind,  
 An empty Mother, Voice without a Mind.  
 I dying sounds fetch back with living tone,  
 And others mock with Words that are my own.  
 I in thy Ears my Habitation found,  
 And if thou mean'st to paint me, paint a Sound.  
 Matthew Coppinger, *Poems, songs and love-verses, upon several subjects by*  
*Matthew Coppinger*, 1682

The most well known version of a myth involving Echo in the Early Modern period is Ovid's tale of Echo's hopeless love for Narcissus. In this version the garrulous nymph is punished for her ability to distract Juno from Jupiter's amours by being forced to use the words of others – '*aliena verba*'. In his influential sixteenth-century translation and interpretation of these tales, Arthur Golding is clear in his condemnation of what he calls the 'babbling Nymph,' calling her actions the 'lewd behaviour of a bawd' (Epistle, 107–108).<sup>58</sup> Whether or not Webster intends any detailed allusion to Ovid's story in his Echo scene, it is surely impossible for early modern audiences to extirpate entirely from their memories the story of the 'babbling nymph' who offers her body to an unwilling youth. The echo scene thus holds out the possibility of a darker reading of the Duchess than the remainder of the play (unlike its sources) would seem to authorise. But it is not necessary to attribute Golding's negative judgment of Echo to Webster in order to assume that the primary function of the allusion is to explore and dramatise the power of the Duchess's speech.

Ovid's story offers a paradoxical reading of a female vocality which, while powerful, is nonetheless forced to refract its meaning through the words of another (*aliena verba*): 'By chaunce the stripling being strayde from all his companie, Sayde: is there any bodie nie? straight Echo answerde: I' (3, 473–474).<sup>59</sup>

<sup>58</sup> Gina Bloom discusses this interpretive move on Golding's part in her interesting discussion of the Echo myth in *Voice in Motion*, chapter 4.

<sup>59</sup> Golding William, *The XV Bookes of P. Ovidius Naso, entytuled Metamorphosis* (London, Willyam Seres: 1657) 72.

Golding's translation perfectly captures the thematic point here: in his play on 'nie' and 'I' he points up the fracturing of identity that occurs through Echo's use of *aliena verba*. To whom exactly does the pronoun 'I' point here? Who speaks it? Whose identity is established by it? Webster also plays on the slippage of identity in the play of voice and echo:

Antonio: Tis very like my wife's voice.

Echo: Ay, wife's voice.

Ay, or a punning 'I', the personal pronoun, emerges as a fragment of Antonio's 'my'. In her deconstructive reading of the Narcissus story, Claire Nouvet shows that this slippage of meaning between the original utterance and its echo is in fact fundamental to the operation of language: 'as soon as it appears, language 'echoes', that is, diffracts into a potentiality of alternative meanings without providing us with the means to decide on any true, proper meaning'.<sup>60</sup> For Nouvet the key moment is when Narcissus says '*huc coeamus*', meaning 'let us meet', only to have Echo respond '*Coeamus*,' by which she means 'let us unite/copulate'. Something similar seems to happen in Webster's scene. The central impasse of meaning in the scene occurs when Antonio refuses to 'talk' with this echo, refuses to give it the status of an interlocutor:

Antonio: Echo, I will not talk with thee, | For thou art a dead thing.

Echo: Thou art a dead thing.

(5, 3, 38–39)

Has Antonio said this (thou refers to an Other)? Or has something external to Antonio said this to him (thou refers to Antonio)? Has Antonio in some sense said this *to himself* (I and thou merge)? Early modern culture's understanding of voice as a material flux deepens the significance of Nouvet's insight into scenes of verbal echoing, preparing us for the third possibility. I and thou merge through the mediation of a maternal voice which calls up or invokes the possibility of the kind of pre-semantic relationality described by Cavarero, but also implicit in early modern descriptions of maternal 'imprinting' on the foetal body and mind by the 'aery spirits' of the sensitive soul.<sup>61</sup> The fact that Antonio does not control the meaning

<sup>60</sup> Nouvet C., "An Impossible Response: The Disaster of Narcissus" 107, *Yale French Studies* 79 (1991) 103–134.

<sup>61</sup> On the 'relationality of the vocalic', see Cavarero, *For More than One Voice* 169; on 'imprinting' see Crooke, *Mikrokosmograpia* 312; and Paré Ambroise, *The Workes of that Famous Chirurgion Ambrose Parey*: tr. Johnson T. (London, Th. Cotes and R. Young: 1634), who writes intriguingly that 'monsters [...] take their cause and shape by imagination [...]

of his words here, that they turn out to be inhabited by other seemingly ghostly meanings, dramatises at a linguistic level the psychological 'rupture' endured by Ferdinand when he experiences his own blood as tainted by the blood of childbirth. Like Bosola, Antonio feels 'haunted' by the Duchess, who momentarily appears to him: 'on the sudden, a clear light | Presented me a face folded in sorrow' (5, 3, 44–45). But he is also haunted in the sense of being visited internally by spirits or disease: like his words, which are inhabited by foreign meanings as they return to him, his body feels a rising fever ('I'll be out of this ague' (5, 3, 47)) that appears to be the secondary physical symptom of *emotional* response. When Delio says the face comes from '[Antonio's] fancy, merely,' he is not entirely wrong. Even if we are to imagine a 'real' haunting here, the play endorses a reading of this moment in terms of the imagination's power to 'carry' a person away – to disable his or her reason by means of a 'rupture' or indeed even a 'rapture' in the mind.

The echo of a maternal voice in the male speaker's own voice thus dramatises once again the passibility of the passionate subject whose internal feelings are not fully his own but act instead precisely as *emotions* – involuntary perturbations stirred by a complex interaction between internal and external forces. It also establishes quite clearly a connection between a sense of being 'haunted' by melancholy and the power of the maternal body as a model for inter-subjective emotional relationship. As Bos argues, the waning power of humoralist explanation gives rise to more complex and dynamic interactions between 'mind' and 'body'.<sup>62</sup> Just as Bosola had tried earlier to deny the connection between his grief and his mother's body, as he dies he tries to silence the internal echo of the Other: 'We are only like dead walls, or vaulted graves, | That, ruined, yields no echo' (5, 5, 96–97). Yet of course Bosola's evocation of the echo *does* echo – it echoes through the scene we have just witnessed, giving the lie to his claim to perfect solitude by diffracting his own particular meaning through the Duchess's answering spirit. His 'melancholic' final words seem to indicate unwittingly a sense of being enmeshed in a world of feelings and emotions not fully his own:

---

for the force of imagination hath so much power over the infant that it sets upon it the notes or characters of the thing conceived' (Paré, *Workes* 978).

<sup>62</sup> Bos, "Rise and Decline of Character" 41–42.

O, this gloomy world!  
 In what a shadow, or deep pit of darkness,  
 Doth, womanish and fearful, mankind live!  
 (5, 5, 99–102)

Why 'womanish'? One answer could be that the image of a child immersed in the dark pit of the womb, subject as we have seen to the turbulent impressions of its mother's 'passionate appetites,' haunts the men of this play as a model for their own emotional conditioning in a 'gloomy world' beyond their control. Although Webster's materialism certainly does not leave classical humoralism entirely behind, the play's exploration of melancholy does suggest a clear movement towards the dynamic conception of the passions that would eventually render the humoral one primarily figurative.

### Selective bibliography

- AGRIPPA HEINRICH CORNELIUS, *Three Books of Occult Philosophy* (London, Gregory Moule: 1651).
- ARIKHA N., *Passions and Tempers. A History of the Humours* (New York: 2007).
- ARISTOTLE, *De Anima*: ed. McKeon R. (New York: 1941) [*The Basic Works of Aristotle*].
- ARMSTRONG D. – HANSON A., "The Virgin's Neck: Aeschylus, Agamemnon 245 and other texts", *Bulletin of the Institute of Classical Studies* 33 (1986) 97–100.
- AUSTERN L., " 'My Mother Musicke': Music and Early Modern Fantasies of Embodiment", in Miller N. – Yavneh N. (eds.), *Maternal Measures. Figuring Caregivers in the Early Modern Period* (Aldershot: 2000) 239–282.
- AUSTIN WILLIAM, *Haec Homo. Wherein the Excellency of the Creation of Woman is Described* (London, Richard Olton: 1637).
- BABB L., *The Elizabethan Malady. A Study of Melancholy in English from 1580–1642* (East Lansing: 1951).
- BARTHES R., *Image, Music, Text* (New York: 1977).
- BICKS C., "Planned Parenthood: Minding the Quick Woman in *All's Well*", *Modern Philology* 103.3, (2006) 299–331.
- BLOOM G., *Voice in Motion. Staging Gender, Shaping Sound in Early Modern England* (Philadelphia: 2007).
- BOS J., "The Rise and Decline of Character: Humoral Psychology in Ancient and Early Modern Medical Theory", *History of the Human Sciences* 22, 3 (2009) 29–50.
- BURKS D., " 'I'll want my Will Else': The Changeling and Women's Complicity with their Rapists", *English Literary History* 62, 4 (1995) 759–790.
- CAVARERO A., *For More than one Voice. Toward a Philosophy of Vocal Expression*: tr./intr. Kottman P.A. (Stanford: 2005).
- CROOKE HELKIAH, *Mikrokosmographia. A Description of the Body of Man, together with the Controversies and Figures thereto Belonging/Collected and Translated out of all the best Authors of Anatomy, especially out of Gasper Bauhinus and Andreas Laurentius* (London, W. Iaggard: 1615).
- DESCARTES RENÉ, *The Philosophical Writings of Descartes, Vol. III Correspondence*: trs. Cottingham J. – Stoothoff R. – Murdoch D. – Kenny A. (Cambridge: 1991).
- DIXON T., *From Passions to Emotions. The Creation of a Secular Psychological Category* (Cambridge: 2003).
- GOLDING ARTHUR, *The XV Bookes of P. Ovidius Naso, entytuled Metamorphosis* (London, Willyam Seres: 1657).
- GORDON B., *Monteverdi's Unruly Women. The Power of Song in Early Modern Italy* (Cambridge: 2004).
- GREENFIELD S. – BARASH C. (eds.), *Inventing Maternity. Politics, Science, and Literature, 1650–1865* (Lexington KY: 1999).
- JACKSON S., "Melancholia and the Waning of Humoral Theory", *Journal of the History of Medicine and Allied Sciences* 33, 3 (1978) 367–376.
- JAMES S., *Passion and Action. The Emotions in Seventeenth Century Philosophy* (Oxford: 1997).
- JORDEN EDWARD, *The Suffocation of the Mother* (London: 1603).
- KING H., "Once Upon a Text: Hysteria from Hippocrates", in Gilman S. – King H. – Porter R. – Rousseau G.S. (eds.), *Hysteria Beyond Freud* (Berkeley-Los Angeles-Oxford: 1993) 3–90.
- KRISTEVA J., *Black Sun. Depression and Melancholia* (New York: 1989).
- LANGE M., *Telling Tears in the English Renaissance* (Leiden: 1996).
- LAURENTIUS ANDREAS, *A Discourse of the Preservation of Sight. Of Melancholike Diseases; of Rheumes, and of Old Age*: ed. Larkey S. (Oxford: 1938).
- MCCRACKEN P., *The Curse of Eve, The Wound of the Hero. Blood, Gender, and Medieval Literature* (Philadelphia: 2003).

- MIDDLETON THOMAS, *Women Beware Women*: ed. Carroll W.C. (London: 1994).
- MILLER N. – YAVNEH N. (eds.), *Maternal Measures. Figuring Caregivers in the Early Modern Period* (Aldershot: 2000).
- NOUVET C., "An Impossible Response: The Disaster of Narcissus", *Yale French Studies* 79 (1991) 103–134.
- PARE AMBROISE, *The Workes of that famous chirurgion Ambrose Parey*: tr. Johnson T. (London, Th. Cotes and R. Young: 1634).
- PASTER G., *Humoring the Body. Emotions and the Shakespearean Stage* (Chicago: 2004).
- , *The Body Embarrassed. Drama and the Disciplines of Shame in Early Modern England* (Ithaca: 1993).
- PASTER G. – FLOYD-WILSON M. – ROWE K. (eds.), *Reading the Early Modern Passions. Essays in the Cultural History of Emotion* (Cambridge: 2003).
- PETERSON K., "Historica Passio: Early Modern Medicine, King Lear, and Editorial Practice", *Shakespeare Quarterly* 57, 1 (2006) 1–22.
- , "Shakespearean Revivifications: Early Modern Undead", *Shakespeare Studies* 32 (2004) 240–267.
- PORTER R., "Barely Touching: A Social Perspective on Mind and Body", in Rousseau G. (ed.), *The Languages of the Psyche. Mind and Body in Enlightenment Thought* (Berkeley-Los Angeles: 1990) 45–81.
- SCHOENFELDT M., *Bodies and Selves in Early Modern England. Physiology and Inwardness in Spenser, Shakespeare, Herbert, and Milton* (Cambridge: 1999).
- , "Commotion Strange: Passion in Paradise Lost", in Paster G. – Floyd-Wilson M. – Rowe K. (eds.), *Reading the Early Modern Passions Essays in the Cultural History of Emotion* (Cambridge: 2003) 43–68.
- SHAKESPEARE WILLIAM, *Henry V*: ed. Taylor G. (Oxford: 1982).
- SILVERMAN K., *The Acoustic Mirror. The Female Voice in Psychoanalysis and Cinema* (Bloomington-Indianapolis: 1988).
- SISSA G., *Greek Virginity* (Cambridge: 1990).
- SMITH B., *The Acoustic World of Early Modern England. Attending to the O-Factor* (Chicago: 1999).
- SOLOMON R.J., "You've Got to Have Soul: Understanding the Passions in Early Modern Culture", forthcoming in Pender S. – Struever N. (eds.), *Rhetoric and Medicine in Early Modern Europe* (Aldershot: 2012).
- SPENSER EDMUND, *View of the Present State of Ireland*: ed. Renwick W.L. (Oxford: 1970).
- TAYLOR C., *The Sources of the Self. The Making of the Modern Identity* (Cambridge, Mass.: 1989).
- VAUGHAN WILLIAM, *Approved Directions for Health, both Naturall and Artificiall Derived from the Best Physitians as well Moderne as Auncient* (London: 1600).
- VIVES JUAN LUIS, *The Passions of the Soul. The Third Book of De Anima et Vita*: ed. Norena C. (Lewiston NY: 1990).
- WALL W., *Staging Domesticity. Household Work and English Identity in Early Modern Drama* (Cambridge: 2002).
- , "Just A Spoonful of Sugar: Syrup and Domesticity in Early Modern England", *Modern Philology* 104, 2 (2006) 149–172.
- WEBSTER JOHN, *Duchess of Malfi and Other Plays*, ed/intr. Weis R. (Oxford: 1996).
- , *The Tragedy of the Dutchesse of Malfy* (London: 1623) <http://www.luminarium.org/sevenlit/webster/duchess.htm>.
- WILLIS THOMAS, *Two Discourses Concerning the Soul of Brutes, Which is that of the Vital and Sensitive Man* (London: 1683); repr. Scholars' Facsimiles (Gainsville: 1971).
- WRIGHT THOMAS, *The Passions of the Mind in General*: ed. Newbold W. (New York: 1986).
- , *The Passions of the Minde in Generall* (London: 1604).





THE SLEEPING MUSICIAN.  
ARISTOTLE'S VEGETATIVE SOUL AND RALPH CUDWORTH'S  
PLASTIC NATURE

Diana Stanciu

*Summary*

While trying to invalidate Descartes' sharp division between matter and intellect as *res extensa* and *res cogitans*, Ralph Cudworth opposes physiology as mechanically conceived and replaces it with the concept of 'plastic nature'. This plastic nature is responsible for order and regularity as signs of the incorporeal principles guiding Cudworth's 'intellectual system of the universe,' at both the macrocosmic and microcosmic level. However, plastic nature is described just as a mark of the intellect in the entire corporeal world and not as a part or a faculty of the intellect itself. It is actually deprived of awareness and knowledge. Moreover, the human soul is not itself conscious of the activity of plastic nature within itself, within the soul. This complex account of plastic nature may be generated by Cudworth's attempt to harmonise such different sources as Plato, Aristotle, Plotinus, the Stoics, Galen, Harvey, Paracelsus and van Helmont while simultaneously trying to challenge Descartes' definition of being as cogitation and self-awareness. And Mosheim, Cudworth's later editor and translator into Latin, may have further cultivated the ambiguity of the concept of plastic nature.

*Mechanical physiology and plastic nature. Two opposed concepts*

In his *True Intellectual System of the Universe* (1678), Ralph Cudworth asserts that human souls are not always conscious of whatever they have in them, in the same way that a sleeping musician is not himself conscious of his musical skills and songs, which are nevertheless still somehow inside him. Thus, it should be possible for the soul to possess some vital energy without being expressly conscious of it.<sup>1</sup> Otherwise, human souls in 'profound sleeps, lethargies and apoplexies' and also 'the embryos in the womb' would cease to have any being.<sup>2</sup> Therefore, Cudworth's ostensible

---

<sup>1</sup> Cudworth Ralph, *The True Intellectual System of the Universe* (London, Royston: 1678, facsimile repr. Stuttgart: 1964) 160.

<sup>2</sup> Cudworth, *The True Intellectual System* 160.

assumption is that awareness is not essential to life. And in support of that, he presents two types of actions that humans perform ‘non-attendingly’.<sup>3</sup> First, he explains that one cannot always tell how one’s brain is affected by different ‘motions and figurations’ in one’s ‘phantastic thoughts’, just as one is not aware of that ‘vital sympathy’ by which one’s soul is united to the body, but only of its effects. Second, he shows that sometimes one cannot even tell how one’s soul is affected by the different motions of one’s own body.<sup>4</sup> To illustrate the first case, he gives the example of dreams, in which ‘cogitations’ and ‘coherent dialogues’ between the soul and other persons develop without the soul itself being aware of them, although the soul itself remains ‘the poet and inventor of the whole fable’.<sup>5</sup> For the second case, his first example is that of respiration or ‘that motion of the diaphragma and other muscles’, of which the soul is not always conscious, especially while asleep. He follows this with the example of the motion of the heart, where he quotes Harvey, ‘that curious and diligent inquirer into nature’, against Descartes, who offers a mechanical explanation of the systole and diastole as caused by some ‘pulsific’, corporeal quality in the substance of the heart itself.<sup>6</sup>

Mechanism is actually refuted, together with atheism, at the very beginning of Cudworth’s *True Intellectual System of the Universe*, not only in connection with the human body, but also with regard to the whole universe, and referring not only to Descartes, but to his ancient sources as well. This refutation of mechanism and of its ancient atomist antecedents is based not only on Platonic views (as one might expect from a ‘Cambridge Platonist’ like Cudworth),<sup>7</sup> but also on those of Aristotle. Indeed, Cudworth tries to demonstrate the concordance between the Platonists and Aristotle in their refutation of atomism. He quotes Aristotle extensively in

<sup>3</sup> Cudworth, *The True Intellectual System* 160.

<sup>4</sup> Cudworth, *The True Intellectual System* 160–161.

<sup>5</sup> Cudworth, *The True Intellectual System* 161.

<sup>6</sup> Cudworth, *The True Intellectual System* 161; cf. Lotti B., *Ralph Cudworth e l’idea di natura plastica* (Udine: 2004) 233: this *vis pulsifica* is actually an old Galenic and scholastic idea connected to the pulsation of the heart.

<sup>7</sup> The Cambridge Platonists were fellows or students of two colleges in Cambridge: Christ’s and Emmanuel. Benjamin Whichcote (1609–1683), Henry More (1614–1687), Ralph Cudworth (1617–1688) and John Smith (1618–1652) formed the inner circle of the group. Other contemporaries associated with them were Nathaniel Culverwell (1619–1651) and Peter Sterry (1613–1672). Among their younger followers can be counted George Rust († 1670), John Norris (1657–1711) and Anne Conway (ca. 1630–1679). Two other kindred spirits could be Joseph Glanville (1638–1680) and Jeremy Taylor (1613–1667).

support of his own criticism of the so-called 'atomical physiology',<sup>8</sup> above all when he wants to prove that, generally, it is the atheistic system of the world that makes all things materially and mechanically necessary, and that such a system is built on a peculiar 'physiological' hypothesis 'which is called by some atomical or corpuscular, by others mechanical'.<sup>9</sup> The main targets of Cudworth's criticism are the suppositions of atheistic 'atomical' physiology that the body is nothing more than extended matter, and that nothing is to be attributed to it besides magnitude, divisibility into parts, shape and position, together with motion or rest. He also criticises the view that motion is so conceived that no part of the body can ever move itself, but is always moved by something else.<sup>10</sup> In this sense, according to Cudworth, again Aristotle did not disagree with Plato, as both posited 'a substance separable and also actually separated from sensibles', an 'immovable nature or essence'.<sup>11</sup> Moreover, Cudworth insists that, besides asserting an incorporeal deity and an immovable first mover, Aristotle also followed Plato 'in physiologising by forms and qualities and rejecting the mechanical way by atoms'.<sup>12</sup> And Cudworth is right in this sense, as Aristotle's teleology was indeed directed against the atomists and especially against Democritus.<sup>13</sup>

Physiology is then described by Cudworth as that which deals with the corporeal and which, as such, must be primarily mechanical.<sup>14</sup> Thus, while refuting mechanism, Cudworth also refutes physiology as mechanically conceived, and uses here the ideas of Aristotle along with those of the Platonists. The term Cudworth prefers, and which he opposes to mechanical physiology, is that of 'plastic nature',<sup>15</sup> which is responsible for the order

<sup>8</sup> Cudworth, *The True Intellectual System* 8, 10.

<sup>9</sup> Cudworth, *The True Intellectual System* 7.

<sup>10</sup> Cudworth, *The True Intellectual System* 7.

<sup>11</sup> Cudworth, *The True Intellectual System* 19.

<sup>12</sup> Cudworth, *The True Intellectual System* 53; Cudworth Ralph, *A Treatise Concerning Eternal and Immutable Morality with A Treatise of Free Will*, ed. Sarah Hutton (Cambridge: 1996) 39.

<sup>13</sup> Cf. Aristoteles, *De generatione animalium* V8, 789a8–b15.

<sup>14</sup> Cudworth, *The True Intellectual System* 25, 32, 39.

<sup>15</sup> A possible source for the concept is the passage in *Timaeus* 42d referring to the moulding (Gr. *platein*, Lat. *plasmare*) of the mortal bodies and the way they are united to the souls, cf. Lotti, *Ralph Cudworth* 188–189. The Greek adjective is *plastos* (formed, shaped) and the noun is *plastēs* (moulder, modeller), cf. Bonifazzi C., *The Soul of the World. An Account of the Inwardness of Things* (Washington, DC: 1978) 55. Ideas from Neoplatonism and Aristotelianism are generally combined with ideas in *Timaeus* when accounting for the creation and order of the universe from the Middle Ages on, cf. Carré M.H., *Phases of Thought in England* (Oxford: 1949, repr. Westport, Connecticut, 1972) 130–131.

and regularity in both the body and the universe. Nevertheless, despite this rational order that it stands for, plastic nature is not defined by awareness and the capacity of knowledge. The metaphor of the sleeping musician and the other examples used by Cudworth have already suggested that. Even if nature 'acts artificially and teleologically', it cannot but 'mimick' the divine art and wisdom since it does not understand either 'the ends which it acts for' or the 'reason of what it does' in order to attain them. Thus, nature is not capable of 'consultation or deliberation'; it cannot 'act electively or with discretion'.<sup>16</sup> And through this, while criticising Descartes' mechanism, Cudworth also argues against his attempt to define being through cogitation and awareness.

At first sight, there are simply a number of assumptions here which deal with psychology and physiology in a manner that opposes Descartes. However, contextualisation and detailed analysis reveal that there is much more to be said. For instance, the whole passage that begins with the metaphor of the sleeping musician should be understood as belonging to a somewhat separate, self-contained *Digression Concerning the Plastick Life of Nature*<sup>17</sup> within Cudworth's *True Intellectual System of the Universe*, where he discusses vital energies without express awareness. Nevertheless, this passage should be interpreted in the wider context of the 'intellectual system' that Cudworth tries to devise in the treatise as a whole. Without doubt, the concept of plastic nature is introduced with the explicit intention of invalidating not only Descartes' mechanism but also all attempts to reduce nature to material necessity. Furthermore, Descartes' definition of being as cogitation and awareness is presented as an indication of atheism and refuted together with it not only in the passage on plastic nature, but also in the entire treatise. Here, as elsewhere in his work, Cudworth presses for his ideas of a 'right intellectual system of the universe' and of an incorporeal deity in order to demonstrate that 'life, cogitation and understanding' do not essentially belong to matter, but are 'the peculiar attributes and characteristics of substance incorporeal'.<sup>18</sup> And in this sense he refutes not only the ideas of the atomists and of Descartes, but also the

---

On plastic nature, see also Lotti, *Ralph Cudworth* 35, 175–256. On the natural philosophy of the Cambridge Platonists referring to the plastic nature see Cassirer E., *The Platonic Renaissance in England* (Edinburgh: 1953) 147, n. 1. On Cudworth and plastic nature see also Bonifazzi, *The Soul of the World* 62–63 and on plastic nature in general, Bonifazzi, *The Soul of the World* 54–80.

<sup>16</sup> Cudworth, *The True Intellectual System* 171.

<sup>17</sup> Cudworth, *The True Intellectual System* 146–173.

<sup>18</sup> Cudworth, *The True Intellectual System* 146.

opposed ideas of the Stoics and 'hylozoists', whom he presents as asserting that 'life and perception or understanding should be essential to matter as such or that all senseless matter should be perfectly and infallibly wise'.<sup>19</sup> This is why Cudworth criticises not only the atomists, but also the 'cosmo-plastic' or Stoic atheists and the 'hylozoic' or Stratonical atheists,<sup>20</sup> the latter also offering him the chance to refute Hobbes and Spinoza. To summarise, Cudworth opposes not only those who draw too sharp a line of separation between matter and intellect, or between the sensible and the intelligible, but also those who try to identify them.

However, the atomists and Descartes remain the main target of the passage on the plastic nature since, despite their error of ascribing 'intellectual' qualities to matter, the Stoics and the hylozoists still have the merit of positing the existence of plastic nature. The peculiar way in which Cudworth sometimes borrows Stoic concepts, while other times he criticises the Stoics, will be described in more detail below. Here, it is necessary to observe only that Cudworth, while sharing with them the concept of plastic nature, remains careful to refute the Stoic and Hylozoic tendency of 'perverting' or 'abusing' the notion of plastic nature 'to make a certain spurious and counterfeit God-Almighty of it (or a First Principle of all things)'. Such a notion would contradict his principle that there is only one 'perfect mind or consciously understanding nature presiding over the universe'.<sup>21</sup> But, having taken all these precautions, in his intellectual system of the universe Cudworth still needs to introduce the idea of a plastic nature that is never mechanically conceived (as physiology can be). Unless one admits the idea of a plastic nature that is not mechanical and that acts regularly towards an end, one should accept either that phenomena happen accidentally, without the guidance of any mind or understanding<sup>22</sup> – which would be nonsensical – or that free will and freedom of any kind do not exist and God is the immediate efficient cause of everything,<sup>23</sup> down to the smallest body of 'every gnat and fly'.<sup>24</sup> Therefore, Cudworth rejects both the view that all things are produced accidentally or by the unguided mechanism of matter and the opposed view that

<sup>19</sup> Cudworth, *The True Intellectual System* 145.

<sup>20</sup> Cudworth, *The True Intellectual System* 145–146.

<sup>21</sup> Cudworth, *The True Intellectual System* 172.

<sup>22</sup> Cudworth, *The True Intellectual System* 148.

<sup>23</sup> Cf. Lotti, *Ralph Cudworth* 182: The relationship between God and matter, after the creation, is always indirect, mediated by plastic nature.

<sup>24</sup> Cudworth, *The True Intellectual System* 147.

God himself does all things immediately and miraculously, regardless of the fact that they are all so masterfully created that 'Galen professed he could never enough admire that artifice which was in the leg of a fly'.<sup>25</sup> Plastic nature thus acts as an inferior and subordinate instrument of God, being responsible for the regular and orderly motion of matter.<sup>26</sup> It constitutes the means through which the divine intellect, that does not remain confined within itself, will 'print its stamps and signatures everywhere throughout the world'.<sup>27</sup>

To sum up, one can notice here that the passage on plastic nature is apparently well integrated within the wider context of the 'intellectual system' that Cudworth conceives in his treatise, a universe in which the decrees of the divine will are carried out by an agent (or executioner), the operative, energetic or efficient cause appointed, which is plastic nature. However, when taking all of Cudworth's sources into account, the fact that plastic nature as 'efficient cause' or 'agent' does not have awareness or the ability to know may create some incongruities in Cudworth's system. It may be difficult to understand how such an 'agent' may be able to execute solely by virtue of the traces of divine reason that are preserved in it, not through its own power of decision. Additionally, if there is a plastic nature that governs the motion of matter throughout the corporeal world according to specific laws, then the same should apply to the formation of plants and animals in order to assure an 'apt coherent frame and harmony of the whole universe'.<sup>28</sup> At any rate, this is what Cudworth maintains and in this sense the 'agency' of plastic nature needs to be further explained. For instance, in the formation of the bodies of animals, it is one and the same thing that directs the whole in framing the eye, the ear, the hand or the foot, in delineating the veins, the arteries, in fabricating the nerves, in projecting the muscles and joints and in designing and organising the heart and the brain. The same idea also appears elsewhere in Cudworth, when he states that the plastic nature 'virtually' contains within itself 'the forms of all the several organical parts of animals' and that it 'displays them gradually and successively, framing an eye here and an ear there'.<sup>29</sup> One and the same thing must have in it 'the entire idea' and 'the complete

---

<sup>25</sup> Cudworth, *The True Intellectual System* 147.

<sup>26</sup> Cudworth, *The True Intellectual System* 147.

<sup>27</sup> Cudworth, *The True Intellectual System* 150.

<sup>28</sup> Cudworth, *The True Intellectual System* 151.

<sup>29</sup> Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 77.



model' of the whole organic body, and the same is true for the plastic nature of the entire corporeal universe.<sup>30</sup>

It must thus be accepted that there is plastic nature both at the macrocosmic and at the microcosmic level and that it makes all things 'conspire everywhere and agree together into one harmony'.<sup>31</sup> Aristotle's *De anima* (*On the Soul*) 1.4 is quoted to prove that plastic nature in animals is that which 'holds together such things as of their nature would otherwise move contraryways' or 'which keeps the more fluid parts of them constantly in the same form and figure', 'that which restores flesh that was lost', 'consolidates dissolved continuities', 'incorporates the newly received nourishment' or 'which regenerates and repairs veins consumed or cut off' or 'which causes dentition in so regular a manner'.<sup>32</sup> Aristotle is severely censured, however, for a purported fault that Cudworth finds, and tries to correct, in his work: although he talks everywhere of a nature that acts regularly, artificially and methodically, with the best results as its final goal, he never definitively declares whether this nature is corporeal or incorporeal, substantial or accidental.<sup>33</sup> The fact that he does not determine these points regarding the rational soul, either, makes the matter even more complex for Cudworth. Moreover, Aristotle's followers conclude that his nature is corporeal. In spite of all these, Cudworth maintains that, since it can be neither the matter, nor the forms, nor the accidents of bodies, according to his own principles, plastic nature must be incorporeal in Aristotle even if it is deprived of knowledge and awareness.

Here the Platonists are taken as arbiters of an incorporeal plastic nature because, in Cudworth's view, they seem to affirm both that there is a plastic nature in all particular souls of humans and animals and that there is a general plastic nature of the whole universe, distinct from their world soul.<sup>34</sup> Thus, while stating its incorporeality, Cudworth also differentiates his plastic nature from the Platonic/Neoplatonic *anima mundi* (world

<sup>30</sup> Cudworth, *The True Intellectual System* 163–164.

<sup>31</sup> Cudworth, *The True Intellectual System* 167.

<sup>32</sup> Cudworth, *The True Intellectual System* 166–167. More on Aristotle's biological ideas in Kullmann W., *Die Teleologie in der aristotelischen Biologie. Aristoteles als Zoologe, Embryologe und Genetiker*, Sitzungsberichte der Heidelberger Akademie der Wissenschaften: Philosophisch-historische Klasse 1979, 2 (Heidelberg: 1979).

<sup>33</sup> More on the concept of nature in Aristotle in Zekl H.G., *Aristoteles' Physik. Vorlesung über Natur*, Philosophische Bibliothek 380 (Hamburg: 1987).

<sup>34</sup> Cudworth, *The True Intellectual System* 171.

soul)<sup>35</sup> and insists that Aristotle, in spite of not clearly stating the incorporeality of plastic nature, agrees with the Platonic doctrine that plastic nature is either a 'lower power or faculty of some conscious soul', or else an 'inferior kind of life by itself, depending upon a superior soul'.<sup>36</sup> And by that Cudworth actually avoids acknowledging the existence of a 'mundane soul'. He prefers not to discuss this issue in detail. It is of minor importance to him whether plastic nature is a part or power of a 'mundane intellectual soul' (if such a 'mundane soul' exists) or simply some kind of inferior life in itself. What he clearly states in this sense is only the existence of the plastic nature 'depending immediately upon the Deity itself', that is, 'upon mind or intellect', and being a mark of it.<sup>37</sup> However, this ambiguity in defining plastic nature in comparison to the world soul becomes yet another source of possible incongruity in Cudworth's Platonic 'system'. And that might be emphasised by the fact that he defines plastic nature sometimes as 'life', and at other times as 'power' or 'faculty', without consistently choosing one definition or another. Nevertheless, this will be discussed below, when considering in detail the possible incongruities regarding plastic nature generated in Cudworth's treatise by his multiple sources. Here I would simply mention that Cudworth refers sometimes to a 'plastic life of nature' and other times to a 'vegetative or plastic power of the soul'.<sup>38</sup>

*Possible incongruities generated by the concepts of 'plastic nature'/  
physiology within Cudworth's 'intellectual system of the universe'*

If we compare all of Cudworth's ideas on plastic nature while keeping in mind his Platonic/Neoplatonic stand, it may seem that he contradicts himself when he asserts that plastic nature acts regularly, even artistically, and has a certain finality, but at the same time it also acts 'non-attendingly'. If plastic nature is defined by 'life', 'internal energy' and 'self-activity' and is differentiated from body, which is defined by 'passive capability',<sup>39</sup>

---

<sup>35</sup> On plastic nature as coming from the ancient theory of *anima mundi* see Janet P., *Essai sur le mediateur plastique de Cudworth* (Paris: 1860) 30–32; on the idea that plastic nature does not coincide with the *anima mundi* because it is deprived of awareness or reflection, see Lotti, *Ralph Cudworth* 188.

<sup>36</sup> Cudworth, *The True Intellectual System* 165.

<sup>37</sup> Cudworth, *The True Intellectual System* 171. For an opposed view, see Janet, *Essai sur le mediateur plastique* 30–32.

<sup>38</sup> Cudworth, *The True Intellectual System* 157, 171.

<sup>39</sup> Cudworth, *The True Intellectual System* 163.

how can this 'activity' and 'energy' of plastic nature be explained without awareness and the capacity of knowledge? A more detailed analysis of the Platonic concept of the world soul (*anima mundi*) and of Cudworth's views on that can be revealing here. Thus, in Plato, the intellect is the power that shapes the world and counteracts necessity through teleology; it is the agent in the general teleological scheme while the world soul seems to lack the qualities of a purposeful designer or of a planning architect.<sup>40</sup> Then, in Plato as well as in Cudworth, the intellect is the basic principle, creating as much 'good' as possible and the world soul is one of the implements created and employed by the divine intellect in pursuit of this purpose.<sup>41</sup> However, in Plato, beyond its essential function as the principle of life (*zôê*) and the originator of movement (*kinêsis*), the world soul is also credited with an epistemological function. It is the organ of knowledge and opinion, corresponding on the cosmic scale to the activities of the individual human soul.<sup>42</sup> And this could be a serious difference between Plato's world soul and Cudworth's plastic nature, since the latter is deprived of knowledge and awareness. It was perhaps for this reason that Cudworth avoided defining his plastic nature as similar to the world soul. However, in spite of being thus inferior to the world soul, plastic nature is devised by Cudworth as a means to struggle against necessity, a function ascribed to the intellect in the Platonic system. And this could be by itself a source of incongruities in Cudworth, given also the facts that, in Plato, teleology is connected to intellect and knowledge or awareness,<sup>43</sup> and that Cudworth defines plastic nature as pursuing specific ends and thus acting teleologically, but yet 'non-attendingly'.

Moreover, one may consider whether Cudworth noticed a further possible problem here: despite the fact that such a vital energy acts according to laws,<sup>44</sup> the idea that awareness is not essential to life appears to contradict some theological views expressed by Cudworth in the *True Intellectual System of the Universe, A Treatise Concerning Eternal and Immutable Morality* (1731), *A Treatise of Free Will* (1838), some of his unpublished

<sup>40</sup> Solmsen F., "The Teleological Approach", in Solmsen F. (ed.), *Plato's Theology* (Ithaca, NY: 1942) 98–122, esp. 112.

<sup>41</sup> Plato, *Timaeus* 36d–e, 37c; cf. Solmsen, "The Teleological Approach" 115–116.

<sup>42</sup> Pl. *Ti.* 36e.

<sup>43</sup> Cf. Solmsen, "The Teleological Approach" 101–103.

<sup>44</sup> Cudworth, *The True Intellectual System* 161; Harvey William, *Exercitationes de generatione animalium, quibus accedunt quaedam de partu, de membranis ac humoribus uteri et de conceptione* (London, Du Gardianis: 1651), Ex. 50, 150–151 quoted by Cudworth in the margin.

work (for instance, British Museum Add. Ms. 4979), and in his sermons.<sup>45</sup> Here Cudworth defines 'true religion' as 'an intellectual and truthful system of the universe', opposed to atheism as a 'false system' and he refers, of course, to 'systems and bodies of divinity', the dogmatic religious views which should not escape the censorship of reason and become simply outbursts of enthusiasm. Within such systems, a human soul that partially lacks awareness, but still acts teleologically and artistically, seems to rather undermine his argument that rational beings should act in God's ways from an 'inward rational principle' and out of free will.<sup>46</sup>

Additionally, as already noted, the main focus of Cudworth's entire work is his 'intellectual system of the universe' that pertains, according to the Platonic tradition, to the realm of the 'intelligible' as opposed to that of the 'sensible'. His religious 'inward rational principle' points in fact to the same Platonic intelligible realm reflected in the sensible world. Such an idea is supported by the passage in which the concept of an 'intellectual system' is presented as the 'true' system, to be distinguished from 'the other, vulgarly so called, systems of the world (that is, the visible and corporeal world)', the astronomical systems: the Ptolemaic, the Tychonic and the Copernican.<sup>47</sup> Thus, although claiming not to feel called to write *de omni ente*, Cudworth insists that we consider the whole scale of entity, because the intelligible is at stake and the intelligible is present everywhere, at all levels. And from this point of view, a plastic nature acting regularly and according to rational principles, but still deprived of awareness and knowledge, may again be difficult to maintain and explain.

Furthermore, as shown above, the criticisms raised by Cudworth (and by other Cambridge Platonists) against Descartes and his rationalism, and Hobbes and his empiricism, are in fact that their account of motion is inadequate and that mechanism cannot account for life.<sup>48</sup> Cudworth introduces plastic nature into his system precisely to complement the mechanical view of the body as 'resisting bulk', as 'antitypous extension' incapable of directing its motion.<sup>49</sup> It is in order to criticise mechanism,

---

<sup>45</sup> Cudworth Ralph, *A Sermon Preached Before the Honourable House of Commons on March 31, 1647, being a Day of Public Humiliation* (Liverpool, Thomas Hodgson and London, Edmund Fry: 1831) and Cudworth Ralph, *A Sermon Preached to the Honourable Society of Lincoln's Inn* (London, printed by J. Flesher for R. Royston: 1664).

<sup>46</sup> For instance, see Cudworth, *Lincoln's Inn* 34–36.

<sup>47</sup> Cudworth, *The True Intellectual System* 3.

<sup>48</sup> Carré, *Phases of Thought* 265.

<sup>49</sup> Cudworth, *The True Intellectual System* 163.

and especially Descartes, that he develops a concept of plastic nature that acts organically rather than mechanically. Also in order to refute Descartes, Cudworth limits his own concept of plastic nature to a 'vegetative' and 'executive' function, allowing it no degree of knowledge or awareness. He ensures that plastic nature is conceived only as a mediator between body and soul or, generally, between the sensible and the intelligible, without allowing any identification with any of 'the extremes'. But in such a context one may wonder how specifically Cudworth's plastic nature is devised to 'mediate' between these 'extremes'. The answer to this question requires a few additional explanations.

Thus, Cudworth quotes Aristotle's *On the Soul* (especially 430a and 432a) in support of the distinction between the rational and the sensitive functions of the soul. He insists on the difference between the higher and active part, which acts separately from matter and is impassible, that which knows or understands (*to noêtikon*), and the lower, passive or sympathetic part, which suffers actions from outside and acts in conjunction with the body, that to which sensation belongs (*to aisthêtikon*).<sup>50</sup> Thus, sense is passion and in all sensation there is first a passion in the body of the sentient being, since the motion in that body which moves another is called action and the one in that which is moved by another is called passion.<sup>51</sup> Consequently, bodily passion is mainly described simply as local motion impressed upon the nerves from the outside objects. But this local motion is then propagated and communicated to the brain, where all sensation is made; and Cudworth, following Aristotle, insists that, in fact, sense is not mere local motion generated from one body to another, or a simple resistance of one body to the motion of another, but a cogitation, recognition or vital perception and awareness of these motions or passions of the body.<sup>52</sup> Moreover, Cudworth also holds an Aristotelian view of knowledge that presupposes not only contact, as in Plato, but also action.<sup>53</sup> Thus, he insists that the primary and immediate objects of cognition and knowledge are not things existing outside the mind, but ideas of

<sup>50</sup> Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 54.

<sup>51</sup> Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 49.

<sup>52</sup> Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 50.

<sup>53</sup> Cf. Duhot, J.-J., *La conception stoïcienne de la causalité* (Paris: 1989) 88–89. For Plato's theory of knowledge, see also Kucharski P., "Sur l'évolution des méthodes du savoir dans la philosophie de Platon", in Kucharski P. (ed.), *Aspects de la spéculation platonicienne* (Paris-Louvain: 1971) 259–272.

the mind itself. And, as intelligible reasons (*rationes*) of things, they are actively exerted.<sup>54</sup>

Under such conditions, if sense is not completely deprived of awareness and cogitation, how can plastic nature be deprived of them? What is its status? Does plastic nature function below the level of sensibility? And if it does, then how can it 'mediate' between two things that are both superior to it? Cudworth does not explain at this point that there are indeed places both in *The True Intellectual System of the Universe* and elsewhere in his work where he opposes the spermatic or vegetative or plastic nature/power to the 'cognoscitive' power of the soul (*vis cognitrix*).<sup>55</sup> For the moment, only the term plastic nature is used and it seems to be able simply to oppose mechanism and physiology as mechanically conceived, without being assigned a clear status that would make it play the 'configuring' or forming role Cudworth ascribes to it within his intellectual system of the universe. And then again, if plastic nature is somehow defined as functioning at the vegetative level, below the level of the senses, how can it mediate between the intelligible and the sensible and how can it 'struggle' against necessity as mechanically conceived? Why does Cudworth insist that the soul, or nature in general, may be unconscious of this vital energy within itself? The answer could be that he cannot accept a second active principle in addition to the One, the intellect governing the universe, which is God himself. Consequently, plastic nature in Cudworth cannot be defined by awareness and the capacity for knowledge. As will be shown below, this ambiguity may indeed be generated by Cudworth's attempt to find an alleged concordance between several different ancient schools of philosophy. Such a concordance is not only questionable, but also seems to cause some problems of internal consistency within Cudworth's system.

Plastic nature is thus described sometimes as 'life' and at other times as 'power', or capacity, or faculty (*dunamis*) of the soul; sometimes it is defined as 'energy' (*energeia*) and at other times as 'potentiality', which are all concepts that require fuller detailed discussion below. For the moment, we should briefly observe that out of Aristotle's three different approaches in discussing causes (the semantic approach in the *Physics* 2.3, the physical-metaphysical one in *De partibus animalium* 1 and the logical-

<sup>54</sup> Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 76; Aristoteles, *De anima* 431a and Plotinus, *Enneades* 5.5.1 quoted.

<sup>55</sup> Cudworth, *The True Intellectual System* 171; Cudworth, *A Treatise Concerning Eternal and Immutable Morality* 77.

epistemic one in the *Second Analytics*),<sup>56</sup> it is only the first two that seem to be of interest for Cudworth. The ontological matter/form distinction, as an instrument of analysis, helps Cudworth explain the incorporeality of the vital principle and its intellectual substance. He also needs the dynamic final/efficient distinction to oppose mechanism. However, the actual/potential distinction remains of secondary interest for him: he prefers not to discuss it, or simply overlooks its relevance.

Cudworth may prefer to overlook the logical-epistemic actual/potential distinction because he seems to place plastic nature at the level of sensation and identify it with the vegetative part of the soul. And since it is sensation that in fact represents the realisation of potentiality, the advance of something towards itself and towards actuality,<sup>57</sup> a perfecting,<sup>58</sup> for Cudworth it is not important to discuss the actual/potential difference. He is not interested in perception as described by Aristotle as a distinctly mental and not corporeal act or as a discriminative power from which the highest acts of cognition are reached by a continuous development.<sup>59</sup> Perception is distinguished from nutrition by the fact that, while in the latter the matter of the food is absorbed, the former is receptive of form without matter.<sup>60</sup> The essential fact about perception is the apprehension by the mind of some quality of an object. And a true description of perception requires awareness of form. However, Aristotle explains in *De anima* 3.4 that, while thought is receptive of intelligible form, sense is receptive of sensible form. Thought is the faculty by which we grasp essence while sense is that by which we grasp essence-embodied-in-matter.<sup>61</sup> And the existence of a certain amount of confusion between psychology and physiology in Aristotle's account of perception<sup>62</sup> may actually cause similar confusion in Cudworth as well; this adds to his lack of interest in sensation or perception and to his preference for the concept of vegetative soul.

<sup>56</sup> Duhot, *La conception stoïcienne* 21–24.

<sup>57</sup> Arist. *De An.* 417b6, 16.

<sup>58</sup> Aristoteles, *Physica* 246b2.

<sup>59</sup> Arist. *De An.* 32b18, 424a5, 432a16, cf. Ross W.D., *Aristotle* (London: 1923; repr. London: 1960) 136–137.

<sup>60</sup> Arist. *De An.* 424a18.

<sup>61</sup> Ross, *Aristotle* 137, 146.

<sup>62</sup> Ross, *Aristotle* 137.



*Possible explanations for the alleged incongruities generated by 'plastic nature'/physiology within the 'intellectual system of the universe'*

An answer to all this might be provided by two simultaneous approaches: a more detailed study of concepts such as physiology and plastic nature as described by Cudworth, and a more attentive assessment of his sources. However, if one is to take physiology as understood by Cudworth in its etymological sense, of knowledge about nature (*phusis* + *logos*), or even of natural philosophy, and also to remember that Cudworth defines knowledge according to the Platonic and Aristotelian tradition, then one finds further incongruities: on the one hand, physiology is defined as knowledge about nature, and on the other, it is sometimes mechanically conceived. Moreover, physiology is opposed to plastic nature, and plastic nature is deprived of knowledge. On the basis of these premises, one may deduce on the one hand, that physiology is superior to plastic nature, since it is knowledge, and on the other hand, that physiology is inferior to plastic nature since it can be mechanical, while the plastic nature is dynamic. Such conclusions would be absurd within Cudworth's system, however, and they differ from his own assertions about physiology and plastic nature. The ultimate question, then, is: what does Cudworth understand by nature (*phusis*)? This could be rephrased as: how many definitions of nature does he have? Furthermore, what are his sources? The following sections represent an attempt to offer a survey of possible antecedents of Cudworth's theory of plastic nature. These are the sources he himself quotes, and which seem to have inspired him either directly or indirectly. We will then examine to what extent he pursued the arguments he found in his sources as a whole, or only in part, in order to reach his personal synthesis, and to what extent this synthesis is more or less self-contained.

a) *Aristotle and the finality of nature*

In Aristotle's *Physics*, nature is either an inner impulse to movement, or unshaped material, or form, or even transcendental principle.<sup>63</sup> Nature as the form of a thing is actually the end (*telos*) towards which it develops.<sup>64</sup> For Cudworth too, nature as an inner impulse to movement constitutes the basis for the refutation of mechanism. Nature is conceived as a

---

<sup>63</sup> Ross, *Aristotle* 67–68.

<sup>64</sup> Ross, *Aristotle* 71.

subordinate instrument of the divine wisdom and it is an instrument especially when defined as matter, as in Aristotle, where nature as matter is the means to the end.<sup>65</sup> Cudworth even calls it a 'manuary opificer or executioner' of divine wisdom.<sup>66</sup> He later observes, acknowledging Aristotle's teleology, that Aristotle's nature is 'no fortuitous principle'; it is 'such as does nothing in vain, but all for ends'. He also explains that in Aristotle nature is something that 'in every thing pursues the best'. The 'executing' function of the plastic nature discussed above is thus related to the Aristotelian teleology adopted by Cudworth here. Moreover, the idea that nature 'pursues the best' points to Aristotle's nature as transcendental principle. However, of these definitions, Cudworth appeals primarily to Aristotle because the latter favours teleology against mere mechanism and prefers to study the parts in the light of the whole, instead of treating the whole as mere sum of the parts.<sup>67</sup> Relying on the authority of Aristotle, Cudworth defines thus nature primarily through its finality.<sup>68</sup>

Relevant here is Aristotle's theory of causality regarding the generation of natural phenomena (*phusikê genesis*). For instance, in *Physics* 2.3 (194b16–195b30 and especially 195a21–27), Aristotle presents the four causes while suggesting two pairs of oppositions: that between the material and the formal and that between the efficient and the final. The first opposition represents an ontological point of view, the second a dynamic one. In *Parts of Animals* 1 (639b11), only two causes are taken into account for the explanation of nature, of the way the phenomena are produced: the final and the efficient (or the initial). While quoting *Parts of Animals* 1.2, Cudworth refers to the same idea and explains that the most important of these two causes seems to be the final or 'the intending cause', as this is reason and reason is 'alike a principle in artificial and in natural things'.<sup>69</sup> Thus, while movement from within represented the distinction between natural and manufactured objects in Aristotle,<sup>70</sup> reason represented the link between them since art, as the imitation of nature, requires knowledge of both form and matter because it studies both the end and the means.<sup>71</sup> The procedure of nature is in this sense assimilated

<sup>65</sup> Ross, *Aristotle* 71.

<sup>66</sup> Cudworth, *The True Intellectual System* 54.

<sup>67</sup> Cf. Ross, *Aristotle* 71.

<sup>68</sup> More on Aristotle's teleology in nature in Ross, *Aristotle* 78–81.

<sup>69</sup> Cudworth, *The True Intellectual System* 165.

<sup>70</sup> Ross, *Aristotle* 66–67.

<sup>71</sup> Ross, *Aristotle* 70.

to that of art and the study of nature is included among the constructive sciences rather than the theoretical in *Parts of Animals*.<sup>72</sup> Similar ideas in Cudworth will be presented below.

In the same sequence of thought, Cudworth explains Aristotle's idea that intellect (*nous*) together with nature (*phusis*) are the causes (*aitia*) of the whole universe: intellect as the principal and directive cause, nature as a subservient or executive instrument.<sup>73</sup> This features in *Physics* 2.5, where Aristotle explains that, besides things which exist of necessity, there are also others defined by finality. Things that display finality may do so by thought or by nature.<sup>74</sup> This double causality remains ambiguous, however. For instance, when Aristotle describes the structure of animals as the result of purpose in *On Heaven*, the question that may naturally arise is: whose purpose? Nature is generally described as acting for a purpose, but nature is not a conscious agent; it is only the vital force present in all living things.<sup>75</sup> Here as elsewhere, Aristotle seems to be content, as have been many thinkers inspired by him ever since, with the notion of a purpose which is not the purpose of any mind. His teleology does not necessarily imply intentionality. And this idea is transparent in Cudworth as well when discussing plastic nature without awareness or knowledge.

One should not forget here, however, that in his ethics and in his physics Aristotle displays different views on teleology. While in the ethics the *telos* is happiness (*eudaimonia*), that has a normative import and requires awareness and knowledge (since it is described as the final arbiter of rational thought and ethical obligations in pursuit of the good), in the natural sciences, the *telos* is rather the perpetuation of the type, the preservation of the species whereby living things can share in the eternal and the divine. Nutrition and reproduction provide examples for this.<sup>76</sup> Even if he does not acknowledge it explicitly, in his own work Cudworth seems to adopt this double significance of teleology. The teleological approach specific to the organic life and the model of the natural sciences in Aristotle fits Cudworth's definition of plastic nature while the ethical approach to teleology fits his ethical and theological concerns mentioned above.

And all this is integrated within a Platonic/Neoplatonic 'intellectual system of the universe' in order to harmonise different tendencies in ancient

<sup>72</sup> Aristoteles, *De partibus animalium* 639b16–21.

<sup>73</sup> Cudworth, *The True Intellectual System* 151.

<sup>74</sup> Arist. *Ph.* 2.5, 196b17–25.

<sup>75</sup> Aristoteles, *De caelo* 271a33.

<sup>76</sup> Cf. Ross, *Aristotle* 125–126, 135–136.

philosophy despite the risk of displaying incongruities between these different sources. Furthermore, trying not only to harmonise Plato and Aristotle, but also to bring their views regarding plastic nature into line with those of other ancient philosophers, Cudworth insists that not only Plato and Aristotle, who were 'naturally more addicted to ideas than to atoms, to formal and final than to material causes',<sup>77</sup> but also the first atomists, who accepted the idea of incorporeal substance, used physiology in subordination to theology and metaphysics. Cudworth even tries to show some impartiality here regarding the views of the atomists on causality and finality, explaining that their philosophy emerged from the 'principle of reason that nothing comes from nothing, nor goes to nothing'.<sup>78</sup>

b) *Plotinus and the artificiality of nature*

Cudworth quotes a fragment from Plotinus' *Enneads* 3.2.16 to describe the activity of nature and its rational forming principle as artificial or rather 'art-like',<sup>79</sup> resembling the movements of a dancer. He also insists that, for the ancient mythologists themselves, the nature of the universe was represented by Pan playing upon a pipe or harp and being in love with the nymph Echo, as if nature, 'by a kind of silent melody', made all the parts of the universe 'dance in measure and proportion'.<sup>80</sup> It is certainly not human art that Cudworth, following his source, envisages here. Human art cannot act upon matter other than from outside and at a distance, while nature is another kind of art which, insinuating itself into the things and acting there as an inward principle, 'does its work easily, cleverly and silently'.<sup>81</sup> Nature is art 'incorporated and embodied in matter' and it does not act upon it from outside, mechanically, but from within, 'vitally and magically'.<sup>82</sup> As God is 'inward to every thing', so nature acts immediately upon the matter, as 'an inward and living soul or law in it'.<sup>83</sup> Consequently, plastic nature is divine art acting immediately and inwardly upon nature, not simply human art. When art is said to imitate nature, it

<sup>77</sup> Cudworth, *The True Intellectual System* 52.

<sup>78</sup> Cudworth, *The True Intellectual System* 34.

<sup>79</sup> Cf. Isnardi Parente M., *Techne. Momenti del pensiero greco da Platone al Epicuro*, Biblioteca di Cultura 76 (Florence: 1966) 12: in Plato, *phusis* can be also reduced to an act of divine *dianoia* or of *technê*.

<sup>80</sup> Cudworth, *The True Intellectual System* 155–156.

<sup>81</sup> Cudworth, *The True Intellectual System* 156.

<sup>82</sup> Cudworth, *The True Intellectual System* 156, Plot. *Enneades* 3.8.1 quoted here.

<sup>83</sup> Cudworth, *The True Intellectual System* 156.

means that imperfect human art imitates the perfect art of nature, which is divine art itself.<sup>84</sup>

However, the idea of imitation (*mimêsis*) itself may bring further explanations to Cudworth's concept of plastic nature. While in Aristotle art as imitation of nature requires knowledge of form and matter and studies ends and means, in Plotinus and Plato it has fewer pretensions to knowledge even if it works 'inwardly'. Thus, when defining plastic nature, Cudworth seems to have preferred Aristotle's teleology in the natural sciences on one side, and the Platonic or Neoplatonic definition of art on the other side, in order to avoid the identification of plastic nature with the world soul and the necessity to ascribe it an epistemological function. The combination of Aristotelian and Platonic/Neoplatonic teleology and art seems to explain thus some of the ambiguities in Cudworth. It is also interesting to note here that the relationship between purpose and the good (implying perfection, eternity and indestructibility) is basically explained in Plato's *Timaeus* through the same notion of *mimêsis* (imitation). The visible created cosmos imitates, as far as possible, the perfection of the cosmos of eternal forms. In fashioning the physical world, the divine craftsman has his eyes fixed on the ideal world.<sup>85</sup> Thus, art and teleology do not seem to contradict each other. While Cudworth does not mention this passage, which would have helped him better explain his concept of plastic nature, the idea is nevertheless present in his work.

### c) Aristotle, Plotinus, finality and artificiality

From what has been said so far, one may conclude that, for Cudworth, the resemblance between nature and art does not contradict the finality of nature. On the contrary, Aristotle's views in *Physics* 199b26–33 are quoted by Cudworth in this sense to prove the existence of finality in both art and nature.<sup>86</sup> Following Aristotle, he insists that it is absurd to suppose that purpose is not present in nature because there is no deliberation (*boulêsis*) there. There is finality in art although art does not deliberate. Likewise, there is finality in nature. This serves to support Cudworth's idea of plastic nature as art and finality, as being dynamic and opposed to mechanical physiology. In Plotinus himself, the shaping, 'configuring'

<sup>84</sup> Cudworth, *The True Intellectual System* 155 bis.

<sup>85</sup> Pl. *Ti.* 29a, 30c, 37c.

<sup>86</sup> Cudworth, *The True Intellectual System* 155–156.

power of nature (*plasmare*) had an anti-mechanist function, nature being conceived as an animated, living principle.

The difference in Cudworth is again simply that nature is deprived of awareness. That is why he prefers to refer to Aristotle's text here and to insist that nature does not deliberate (and consequently it has no knowledge and awareness), but that does not prevent it from having a finality. Cudworth always emphasises that it is not human art that he has in mind here. The 'configurating' power of nature is an expression of divine creativity in as much as it is manifested in the 'vitality and ordinating capacity of nature'<sup>87</sup> and also in cosmogony.<sup>88</sup> Aristotle's *Parts of Animals* 1.1 is quoted to strengthen this idea: as there is art in artificial things, so there is in nature 'such a principle or cause' as plastic nature 'by which the heavens and whole world are thus artificially ordered and disposed'.<sup>89</sup>

Cudworth never loses sight of one final problem regarding the difference between nature and human art in respect of plastic nature. Here he quotes Aristotle's *Physics* 199b26–33: both art and nature are teleological, but the difference between them is that art is a power in one thing to effect change in another, and nature a power in one thing to effect change in itself.<sup>90</sup> He continues with Aristotle's example: 'if the art of shipwright were in the timber itself, operatively and effectually, it would there act just as nature does'. The solution too comes from Aristotle: nature may be closer to the medical art when it is being used by the physician to cure himself.<sup>91</sup> This idea serves to strengthen Cudworth's account of plastic nature as being art itself, acting immediately upon the matter as an inward principle in it, but it still does not explain why it should be deprived of awareness since it is active and acts even upon itself. Furthermore, there is an idea in Aristotle's *Physics* 192b8–193b21 that Cudworth seems to ignore here: lack of deliberation does not necessarily imply lack of awareness or lack of knowledge, but on the contrary, it may imply awareness and knowledge. Aristotle explains that the one who deliberates does not yet know, but the artist knows. Thus, the artist already knows his art and proceeds by habit. Nevertheless, such new issues will be discussed later on.

<sup>87</sup> Cf. Lotti, *Ralph Cudworth* 190.

<sup>88</sup> *Pl. Ti.* 55e; cf. Lotti, *Ralph Cudworth* 188–189.

<sup>89</sup> Cudworth, *The True Intellectual System* 168.

<sup>90</sup> Cf. Ross's commentary in Ross W.D. et al. (eds.), *The Works of Aristotle* (Oxford: 1931), vol. 3, 47.

<sup>91</sup> Cudworth, *The True Intellectual System* 155.

d) *Galen and the dunamis diplastikê*

Another antecedent of Cudworth's plastic nature may be Galen's *dunamis diplastikê* (translated in Latin as *facultas formatrix*) in his *On the Natural Faculties* I 5–6 or II 3.<sup>92</sup> This 'moulding', 'configuring' faculty is also defined by Galen as 'artistic' (*technikê*) when it regulates the processes of development and conservation of the living organisms. Moreover, it is teleological while opposing the mechanical and atomistic physiology of Erasistratus. That serves Cudworth's purpose very well, especially as Galen's *dunamis diplastikê* is also deprived of awareness. However, Cudworth quotes Aristotle and Plotinus rather than Galen and, when he does quote Galen, he prefers *On the Utility of the Parts* rather than *On the Natural Faculties*, although the latter was published in London in 1523 in the Latin version of Thomas Linacre and Cudworth may have had access to the original Greek as well (despite the fact that *Bibliotheca Cudworthiana*, the auction catalogue of his library, does not mention it).<sup>93</sup> The fragment he quotes from *On the Utility of the Parts*, the one already mentioned above, regarding the fly and the microscope, is suggestive in terms of his views on plastic nature, and fits his general argument very well. It refers to the constructive art of nature and compares the imitative human art with the 'plasmatic' and living art of nature in order to note the superiority of the latter.<sup>94</sup> Moreover, Galen describes the process of creation, growth and nutrition not as simple activities of nature, compounded of alteration and shaping. His shaping, or moulding (*diaplasia*), refers to the specific ordering of the tissues into organs through formative or 'diaplastic' activity.<sup>95</sup> That in turn supports Cudworth's idea that plastic nature acts in an orderly and regular way, but not mechanically.

Galen's *dunamis diplastikê* is, then, a very plausible source for Cudworth's plastic nature, although not openly acknowledged as such; indeed, Cudworth is generally well-known for his syncretism and his reluctance to acknowledge his sources. In this context, his editor and translator into Latin, Johann Lorenz von Mosheim, makes valuable remarks – among Cudworth's sources regarding plastic nature, Mosheim often quotes Galen.

<sup>92</sup> Cf. Hunter W.B., *The Seventeenth-century Doctrine of Plastic Nature* (Cambridge: 1950) 199, n. 3; Bonifazzi, *The Soul of the World* 55; Lotti, *Ralph Cudworth* 191.

<sup>93</sup> Cf. Lotti, *Ralph Cudworth* 192–193, 201–202.

<sup>94</sup> Cudworth, *The True Intellectual System* 147; Galenus, *De usu partium* 2.7 (3.117–118 K.); 2.8 (3.121–125 K.); 2.9 (3.167 K.).

<sup>95</sup> Galenus, *De facultatibus naturalibus* 1.5 (2.152 K.); cf. Bonifazzi, *The Soul of the World* 55.



However, neither the antecedents to Cudworth's plastic nature already mentioned, nor Galen's concept can entirely explain the lack of awareness and knowledge in Cudworth's plastic nature. Thus, Galen's concept is described as *dunamis* (potentiality) in Greek and as *facultas* (faculty) in Latin. These notes of the concept are in perfect agreement with the lack of awareness of the *dunamis diapistikê* in Galen. But this is not the case in Cudworth's system, where plastic nature is defined, as already observed, both as *dunamis* (potentiality) and as *energeia* (actuality) and as both 'life' and 'faculty' or 'power'. Mosheim may have contributed to this ambiguity himself while trying in fact to solve it: he decided to give plastic nature a more specific definition by reducing its scope and he preferred the term *vis genetrix* (generating power). At the same time he often referred to the concept of vegetative soul while implying that he actually meant plastic nature.<sup>96</sup> The question that then remains is whether the Aristotelian vegetative soul is a concept that could fit in a Platonic 'intellectual' system of the universe such as the one Cudworth conceived.

e) *Plotinus and the reason immersed and diffused into matter* (ratio mersa et confusa)

Up to this point, Cudworth seems to have managed to create some concordance between different ancient philosophers and to define plastic nature in terms of teleology and art. Having declared himself in favour of 'the Aristotelic doctrine concerning the plastic nature of the universe, with which the Platonic also agrees,' and having explained that it may be a 'part of a mundane intellectual soul (that is a lower power and faculty of it)' or simply 'some inferior thing' immediately depending on divine intellect,<sup>97</sup> Cudworth proceeds to describe nature as reason immersed and diffused into matter (*ratio mersa et confusa*).<sup>98</sup> Referring back to Plotinus' idea of nature as divine art, he now explains that it is not the divine art as archetypal, but only as ectypal (Gr. *ektupos* means something which is out of the mould, as an exact copy, but not as a prototype), while matter alone is only 'antitypous extension'. The idea of art as *mimêsis* (imitation) mentioned above seems to be relevant again here.

<sup>96</sup> Mosheim J.L. von, *Systema intellectuale huius universi seu de veris nature rerum originibus commentarii* (Jena, Meyer: 1733) 148–149.

<sup>97</sup> Cudworth, *The True Intellectual System* 171.

<sup>98</sup> Cudworth, *The True Intellectual System* 155 bis, cf. Lotti, *Ralph Cudworth*, 266, n. 58.

Thus, plastic nature, as a 'living stamp or signature of the divine wisdom', is created precisely according to its archetype, but it remains only ectypal, as it is not able to comprehend 'the reason of what itself does'.<sup>99</sup> Here, finally, may be a possible source and explanation for Cudworth's insistence that the soul and nature in general still preserve traces of rationality even when there is no awareness of that. This could also accord with Cudworth's general Platonic 'system'. Quotations by Cudworth from Plotinus' *Enneads* are relevant here. Thus, wisdom is the first thing and nature the last and lowest, for nature is only an image or imitation of wisdom, 'the last thing of the soul, which has the lowest impress of reason', as 'when a thick piece of wax is impressed upon by a seal', the impression being clear and distinct in the upper part and weak and obscure in the lower part, and nature being 'a thing which does only do, but does not know'.<sup>100</sup> Likewise, Cudworth presents plastic nature as a certain power of moving matter, which does not know, but can only do, and seems to be 'just a stamp or a figure in water'.<sup>101</sup> Thus, plastic nature is not pure mind or perfect intellect, nor any kind of pure soul, but something which depends upon it, being just 'an effulgency or radiation' from both mind and soul or rather from 'soul affected according to mind' and generating 'a lower kind of life',<sup>102</sup> the same plastic nature deprived of awareness that Cudworth posits. One should note here, nevertheless, that such an idea does not completely follow the ideas of Plotinus, in whose work nature still preserves traces of awareness, even in a diffused manner. We therefore need to enquire further into the sources and explanations of plastic nature lacking awareness in Cudworth's system, and into the gnoseological implications of such a view.

f) *Nature as habit (hexis), the logoi spermatikoi and the pneuma/tonos/logos model of the Stoics*

Regarding the relationship between intellect and matter, Cudworth also adopts the idea, to be found in Aristotle and also in the Stoics,<sup>103</sup> that

<sup>99</sup> Cudworth, *The True Intellectual System* 155 bis; On *ectypon / archetypon* cf. Lotti, *Ralph Cudworth* 176.

<sup>100</sup> Cudworth, *The True Intellectual System* 156 bis; Plot. *Enneades* 4.4.13.

<sup>101</sup> Cudworth, *The True Intellectual System* 156 bis; Plot. *Enneades* 2.3.17.

<sup>102</sup> Cudworth, *The True Intellectual System* 163; Plot. *Enneades* 3.2.16.

<sup>103</sup> Mosheim, *Systema intellectuale* 168, n. 2. Mosheim here explains that nature as the Stoics defined should be presented according to Diogenes Laertius, *De clarorum philosophorum vitis* 7.148, 459.

nature is a habit (*hexis*) and is in motion due to inner causes according to 'spermatic reasons or seminal principles' (the *logoi spermatikoi* or *rationes seminales* transmitted through medieval Augustinianism).<sup>104</sup> Here he quotes from Diogenes Laertius on the life of Zeno.<sup>105</sup> Cudworth explains furthermore that, in the Stoics, habits are acquired by teaching, industry and exercise, while in Hippocrates<sup>106</sup> they are unlearned and untaught, but may in some sense be said to be also self-taught (*autodidaktos*).<sup>107</sup> He also maintains that, even before the Stoics and Hippocrates, Heraclitus described a regular and artificial nature as 'the fate of things in this lower world' since reason, 'passing through the substance of all things', was 'the seed of the generation of the universe'.<sup>108</sup> However, Cudworth also insists here on countering the doctrine of the 'hylozoists' that life and perception or understanding should be essential to matter as such, or that all senseless matter should be perfectly and infallibly wise.<sup>109</sup>

It could be argued, on the one hand, that it is not surprising that he opposes the Stoics here, as the main objective of Stoic physics is in fact to overcome the dualism between mind and matter taught by other Greek philosophical schools.<sup>110</sup> The Stoics propose a unitary reality, a monism in which God is mind and matter at the same time<sup>111</sup> and everything that acts is a body.<sup>112</sup> And all this contradicts Cudworth's idea of plastic nature and

<sup>104</sup> Cudworth, *The True Intellectual System* 153; cf. Carré, *Phases of Thought* 118–119, 266, Hunter, *The seventeenth-century doctrine* 200, Colish M.L., *The Stoic Tradition from Antiquity to the Early Middle Ages* (Leiden: 1985), vol. 1, 203–206; cf. Lotti, *Ralph Cudworth* 187.

<sup>105</sup> On the inspiration Cudworth found in Diogenes Laertius' *Lives of the Philosophers*, see Hutton S., "Aristotle and the Cambridge Platonists: The Case of Cudworth", in Blackwell C. – Kusukawa S. (eds.), *Philosophy in the Sixteenth and Seventeenth Centuries. Conversations with Aristotle* (Aldershot, Hampshire: 1999) 338.

<sup>106</sup> Mosheim, *Systema intellectuale* 168, n. 3. Mosheim also quotes Hippocrates and he explains that Hippocrates' nature differs greatly from Cudworth's. Actually it does not differ that much. For instance, Hippocrates explains, when referring to mediating nature, that nature is the doctor of maladies since it finds by itself, not by intelligence or knowledge or instruction, the ways and means to do what is convenient. Cf. Hipp. *Epid.* 6.5 (5.315 L.).

<sup>107</sup> Cudworth, *The True Intellectual System* 153.

<sup>108</sup> Cudworth, *The True Intellectual System* 152; cf. Lotti, *Ralph Cudworth* 187.

<sup>109</sup> Cudworth, *The True Intellectual System* 145.

<sup>110</sup> Colish, *The Stoic Tradition* I, 23; see also Sambursky S., *Physics of the Stoics* (New York: 1959).

<sup>111</sup> *Stoicorum veterum fragmenta*, ed. Arnim I. von (Stuttgart: 1903–1905; repr. 1964), vol. I, 85, 87, 102, 153–154, 159–162, 493, 495; vol. II, 299–328, 526; see also Todd R.B., "Monism and Immanence: The Foundations of Stoic Physics", in Rist J.M. (ed.), *The Stoics* (Berkeley: 1978) 137–160.

<sup>112</sup> *Stoicorum veterum fragmenta*, vol. I, 89–90; vol. II, 341, 346a, 358–359, 467, 665, 797, 848; vol. III, 84.

life in general as a purely incorporeal principle.<sup>113</sup> However, on the other hand, the Stoic continuum between mind and body,<sup>114</sup> in which matter is not 'dead' matter in the Cartesian sense, but dynamic matter, charged with vital force, serves Cudworth's idea of plastic nature very well. When asserting that mind is not something external to matter, an abstract ideal quality, but rather an active principle, the creative force permeating the universe and holding it together, Stoic physics is in perfect harmony with the Neoplatonic ideas adopted by Cudworth and discussed above. But when matter is liable to acquire awareness due to such hypotheses, Cudworth immediately refutes the Stoic views.

In the same way, Cudworth prefers to neglect the Stoic biological model of cosmology, despite the inspiration he finds in the Stoics for his concept of plastic nature. The Stoics assert that, just as the universe as a whole is held together by *tonos* (tension, intensity), *pneuma* (breath, spirit) and *logos* (reason), so the physical and metaphysical metabolism and the vital functions of each individual thing in the universe are also regulated by *tonos*, *pneuma* and *logos*. All things are thus related to the cosmic *pneuma*<sup>115</sup> and to each other, since *tonos* and *pneuma* are the same whether they operate on a cosmic level or on the level of the individual being.<sup>116</sup> The Stoic idea that such a common force operates differently in different kinds of creatures would be very helpful for Cudworth, especially when trying to explain that plastic nature is actually deprived of awareness or knowledge.

Thus, for the Stoics inorganic nature is vivified by *hexis*, organic nature by *phusis* and humans by *psychê*.<sup>117</sup> Between *psychê*, on the one hand, and *hexis* and *phusis* on the other, the Stoics draw a sharp distinction, which is qualitative and not merely quantitative.<sup>118</sup> The Stoic *pneuma*, at its lowest level of organisation and concentration, produces simple cohesion in the matter in which it dwells, holding together individual unified bodies. This state of cohesion and coherence is actually called *hexis*<sup>119</sup> and this is

<sup>113</sup> On corporeals and incorporeals in the Stoics, see Duhot, *La conception stoïcienne* 87–100.

<sup>114</sup> Colish, *The Stoic Tradition*, vol. 1, 23.

<sup>115</sup> For more on *pneuma* theory in the Stoics and in early modern authors inspired by them see Papy J., "Lipsius, Atoms and Pneuma? Stoic Physics and the Neostoic Reading of the World", in Papy J. – Hirai H. (eds.), *Justus Lipsius and Natural Philosophy. Handelingen van de Contactfora, KVAB* (Brussels: 2009) 11–19.

<sup>116</sup> Colish, *The Stoic Tradition*, vol. 1, 27.

<sup>117</sup> On *hexis*, *phusis* and *psychê*, see also Bonifazzi, *The Soul of the World* 106.

<sup>118</sup> Colish, *The Stoic Tradition*, vol. 1, 27.

<sup>119</sup> On being and cohesion, see Bonifazzi, *The Soul of the World* 106–128.

what defines Cudworth's plastic nature in general. For the Stoics, *psuchê* alone is rational, being a fragment of the divine *logos*, the highest level of pneumatic activity<sup>120</sup> and this is a distinction that could have helped Cudworth better explain awareness in the individual soul when defining plastic nature. The Stoic *pneuma* seems to be the closest to Cudworth's own plastic nature. However, it would still not help him explain the metaphor of the sleeping musician, since Cudworth insists that the human soul still contains unconscious, 'unattended' elements and the Stoics insist, on the contrary, that, as the divine *logos* permeates and orders the whole universe, so the human *logos* or *pneuma* permeates humans' entire being and accounts for all their activities.<sup>121</sup>

*Pneuma* at the level of *psuchê* applied to Cudworth's metaphor of the sleeping musician should thus have accounted for full awareness regarding all activities, something that Cudworth actually wanted to deny. This is perhaps why he does not refer to it, but rather quotes Plotinus on reason diffused into matter and Aristotle on the inward activity of nature. However, knowledge of this Stoic definition of *pneuma* at the level of *psuchê* may have made Cudworth think that the Platonic notion of the world soul, as defined by awareness and knowledge, was actually not appropriate for explaining plastic nature. Maybe this is why Cudworth preferred the Aristotelian vegetative soul, which did not present any threat of asserting the immanence of the intellect in nature, an idea that would have contradicted Cudworth's theological principles.

The obvious issue here, once more, is that Cudworth cannot accept the pantheistic hints in the Stoic doctrines nor their empiricist gnoseology. Likewise, he opposes Stoic cyclicity<sup>122</sup> even while accepting the *logoi spermatikoi*, which demonstrate cyclicity.<sup>123</sup> Consequently, he insists that plastic nature was the immediate workman and operator while the intellectual nature was the supreme architect and master builder of the world,<sup>124</sup> the same idea referred to above, when discussing Cudworth's inspiration from Plotinus and Aristotle. He may have liked the *pneuma* theory, but not its suggestions of the corporeality of the spiritual entities; for that, he

<sup>120</sup> *Stoicorum veterum fragmenta*, vol. II, 725; vol. III, 219–220, 337–339, 367–376.

<sup>121</sup> *Stoicorum veterum fragmenta*, vol. I, 134–143, 216–223, 518–526; vol. II, 773–789, 823–849; vol. III, 544–656.

<sup>122</sup> Cyclicity was actually appropriated from Heraclitus, cf. Colish, *The Stoic Tradition*, vol. 1, 24.

<sup>123</sup> Cf. Lotti, *Ralph Cudworth* 187.

<sup>124</sup> Cudworth, *The True Intellectual System* 158.

prefers to appeal to Plotinus, who explains the world through the incorporeal acting upon the corporeal, and to Aristotle, who explains the world through final causality.<sup>125</sup>

Thus, his plastic nature is incorporeal. But at the same time it is deprived of awareness. Plastic nature with awareness would have posited a second active principle in the universe, in addition to God. Cudworth seems unable to emerge from this vicious circle, not because he lacks philosophical skills, but rather because he is trying to find consensus between tendencies and schools of thought that are simply too far apart. For the same reason, he discarded passages in Aristotle or Plotinus that would have helped him better define his plastic nature, but that would have also emphasised the differences between the different schools of thought that Cudworth wanted to harmonise. This can also be seen in the following examples.

g) *Hexis-energeia-dunamis: A syncretic combination of Aristotelian, Neoplatonic and Stoic concepts*

As already observed, in his concept of plastic nature, Cudworth combines numerous concepts and distinctions specific to such different authors as Plotinus, Aristotle and the Stoics, but he prefers to use them only partially for fear of not sufficiently emphasising the differences among these authors. Had he been interested in offering a more comprehensive analysis of the concepts he combines, he would have been better able to explain the ambiguities created by the attempted concordance of so many sources. For instance, in Plotinus, the substance or the essence of the One is defined as *dunamis* (*potentia*, potentiality) while in Aristotle the essence of the prime mover is defined as *energeia* (*actus*, actuality, activity). *Praxis* and also *technê* are defined as activity, as too is even local motion.<sup>126</sup> Furthermore, in *Metaphysics* 5 (1022b), Aristotle defines *hexis* (possession, disposition) as *energeia* (actuality, activity) in the case of either having one thing or of making (*praxis*, *technê*) one thing. An alternative term for *hexis* is also *diathesis* (disposition), as an arrangement (*taxis*) of parts in space (*topos*), in potentiality (*dunamis*) or in form (*eidos*). In *Categories* 8b, *hexis* either as possession or as disposition is

<sup>125</sup> Cf. Duhot, *La conception stoïcienne* 87.

<sup>126</sup> Cudworth, *The True Intellectual System* 169.

defined as active, not as passive like the impulses or the capacities, which belong to humans by nature. But, on the contrary, in *Metaphysics* 8–9 and in the *Nicomachean Ethics* 1.8 (1098b33), Aristotle opposes *hexis* as possession or disposition and, thus, defined this time as *dunamis* (potentiality), to *energeia* (or *ergon* as function, task, work). These differences between his sources, Aristotle and Plotinus, as well as those within Aristotle himself, could enable us to unlock Cudworth's own contradictions concerning plastic nature. If Cudworth defines nature according to the Neoplatonists as *dunamis* (potentiality) and according to the Stoics as *hexis* (habit, disposition), then his insistence upon the inner activity (*energeia*) of nature, borrowed from Aristotle, is not always easy to explain.

Moreover, Aristotle himself defines nature and soul sometimes as *dunamis* and at other times as *energeia*. But Cudworth does not seem to be interested in understanding and exploiting the differences between *hexis* as *dunamis* and *hexis* as *energeia* in Aristotle's *Metaphysics*, even though they could have helped him better explain his concept of plastic nature and in particular why and how it can be deprived of awareness and knowledge. Likewise, Cudworth does not seem able, or interested, to fully exploit the value of the comparison between nature and art that he often notices, and the full significance of *praxis* or *technê* in Aristotle's definition of *hexis* as *energeia* in his *Metaphysics*. He also quotes without further discussion a passage from Plotinus, where Plotinus himself actually defines nature as *energeia* (actuality), contrary to his usual definition of nature as *dunamis* (potentiality). The passage refers to 'the energy of nature', which is artificial 'as when a dancer moves, for a dancer resembles this artificial life of nature'.<sup>127</sup> Consequently, the same definition of plastic nature as 'life' and 'energy' seems to continue to create ambiguities. Following this, the fact that Cudworth does not try to explain these ambiguities in his sources, but rather overlooks them, perpetuates some incongruities already pointed out. Under such conditions, one must observe again that, although his attempt to demonstrate the concordance between different ancient philosophical schools helped Cudworth better define his concept of plastic nature, this ideal of concordance finally became an obstacle to a more thorough analysis of the sources and of the concept itself.

---

<sup>127</sup> Cudworth, *The True Intellectual System* 158, quoting Plot. *Enneades* 3.2.16.



h) *Harvey and the Aristotelian medical tradition*

Moving beyond his ancient sources, Cudworth also seems to have found inspiration in some contemporary authors. For instance, when mentioning habit (*habitus, hexis*) as self-taught (*autodidaktos*), Cudworth quotes Harvey's *Exercitationes de generatione animalium*.<sup>128</sup> Mosheim, his translator into Latin and editor, quotes this same passage and also speaks of habit and, moreover, of *natura procreatrix*, since in his work Harvey referred to the idea of nature as self-taught (*autodidaktos*) as well as to the intellectual and artistic/artificial principles it represents.<sup>129</sup> Moreover, Mosheim also notes that, when speaking of *phusis* and *hexis*, Cudworth actually refers to this passage in Harvey rather than to Hippocrates or the Stoics.<sup>130</sup> However, in complete contrast to Cudworth's works, Harvey's *Exercitatio* 49 refers to Aristotle's 'efficient cause' in the generation of animals (*quae sit animalium causa efficiens*). When discussing the formation of the chick in the egg, Harvey speaks not only of 'active' and 'passive', but also of 'actual' vs. 'potential' – the distinction Cudworth generally prefers to overlook – and also of the *facultas formatrix*.<sup>131</sup> It is clear, then, that Cudworth did not follow Harvey in every detail, just as he had not followed Aristotle in every detail, but instead used parts of his work to serve his *philosophia perennis*.

Furthermore, when mentioning the Neoplatonic idea of nature as '*ratio mersa et confusa*, which does not know, but only do', Cudworth again quotes Harvey in the margin and refers in the text to the 'modern judicious writer and sagacious inquirer into nature' who seems fully to agree with his views.<sup>132</sup> He insists that Harvey, after having admired the wisdom and art by which the bodies of animals are framed, concluded either that the vegetative (plastic) nature/power of the soul, 'by which it fabricates and organises its own body', was more excellent than the rational, or else that in the works of nature there was neither prudence nor understanding, these only seeming to be present as a result of the human tendency to apply human patterns to nature, as if nature would produce its effects

<sup>128</sup> Cudworth, *The True Intellectual System* 153; Harvey, *Exercitationes* Ex. 49, 146. On Cudworth and Harvey see also Lotti, *Ralph Cudworth* 228–234.

<sup>129</sup> Harvey, *Exercitationes* Ex. 49, 146.

<sup>130</sup> Mosheim, *Systema intellectuale*, 168, n. 4; see also Harvey, *Exercitationes* Ex. 50, 152–153; cf. Lotti, *Ralph Cudworth* 232.

<sup>131</sup> Harvey, *Exercitationes* Ex. 49, 143.

<sup>132</sup> Cudworth, *The True Intellectual System* 156 bis.

‘in the same manner as we do our artificial works’.<sup>133</sup> Here Mosheim himself quotes Harvey in a footnote, but in contrast to Cudworth he speaks of *natura naturans sive anima mundi*,<sup>134</sup> that which comprehends everything even if God is the only agent.<sup>135</sup> He seems to accept the Platonic world soul and also Harvey’s immanentism here in an attempt to ascribe awareness to plastic nature, while Cudworth does not. What should not be forgotten here is that both Cudworth and Mosheim still equate plastic nature with the vegetative function of the soul, which introduces some new ways of understanding the concept.

However, some questions remain. For instance, why is Harvey so important for Cudworth? From Plotinus, Aristotle and the Stoics he already has all the notions needed for his plastic nature. Why does he prefer to quote Harvey? Mainly because, while continuing the Aristotelian tradition of the *De anima*, Harvey managed to overcome the ambiguities of the Aristotelian commentators and established the immateriality of the vital principle against the materialistic theories of his time.<sup>136</sup> Harvey refutes matter as an absolute principle, as a distinctive feature of objects and especially of living organisms, which he refuses to discuss in terms of aggregation and composition of material elements.<sup>137</sup> Within a teleological and artistic context, he defines plastic nature as an immaterial agent of generation, anatomical construction and physiological processes. That then becomes a necessary correlate of the epigenetic theory that Harvey derived from the Aristotelian tradition.<sup>138</sup>

The *plastica vis naturae* is used by Harvey to explain the dynamic process of generating animal life which he observed and described, for instance in the case of the growth of the chick in the egg.<sup>139</sup> Here it is interesting to note again that Mosheim translated plastic nature into Latin as *vis*

<sup>133</sup> Cudworth, *The True Intellectual System* 156 bis-157. Harvey, *Exercitationes* Ex. 49, 140–148 quoted; here Harvey in fact speaks about efficient cause and Aristotle.

<sup>134</sup> Harvey, *Exercitationes* Ex. 49, 146.

<sup>135</sup> The specific passage is in Ex. 49, 146, quoted accurately not by Cudworth, but by Mosheim, *Systema intellectuale* 167, n. 3.

<sup>136</sup> Pagel W., ‘The Reaction to Aristotle in Seventeenth-Century Biological Thought’, in Underwood A. (ed.), *Science, Medicine and History. Essays on the Evolution of Scientific Thought and Medical Practice Written in Honour of Charles Singer* (London: 1953), vol. 1, 489–509, esp. 502.

<sup>137</sup> Pagel W., *William Harvey’s Biological Ideas. Selected Aspects and Historical Background* (Basel and New York: 1967) 311. Here, however, Pagel forgets the former mechanist lectures of Harvey, cf. Lotti, *Ralph Cudworth* 230.

<sup>138</sup> Harvey, *Exercitationes* Ex. 50, 148–149, cf. Lotti, *Ralph Cudworth* 229.

<sup>139</sup> Harvey, *Exercitationes* Ex. 49, 143; cf. Bonifazzi, *The Soul of the World* 56; Lotti, *Ralph Cudworth* 229–230.

*genetrix* while referring to the vegetative soul<sup>140</sup> and that, when referring to Harvey's views, Cudworth also accepted the idea that plastic nature is actually just a 'power' or 'faculty'.<sup>141</sup> Like Cudworth, Harvey criticised Descartes and especially the Cartesian doctrine of the heart's physiology, opposing to it a vitalist explanation without repeating the traditional doctrines.<sup>142</sup> In his *Exercitationes anatomicae de motu cordis et sanguinis circulatione*, for instance, Harvey defined the heart as 'the fundament of life, the principle of everything, the sun of the microcosm, on which all vegetative life depends'<sup>143</sup> and, like Cudworth,<sup>144</sup> criticised the Galenic and scholastic theory of the *vis pulsifica* adopted by Descartes.<sup>145</sup>

Harvey's system of physiology is thus an Aristotelian one, understood as the proper functioning of the body,<sup>146</sup> but this is the Aristotle of Fabricius or of Padua rather than the Aristotle of the Schools.<sup>147</sup> And Cudworth must have been attracted by the fact that, in natural philosophy, Harvey was an Aristotelian concerned with efficient and final causes, but he may have been equally attracted by the idea that Harvey borrowed his Aristotelian ideas from the medical tradition<sup>148</sup> in order to refute mechanically conceived physiology. Within the Aristotelian medical tradition on plastic nature (*vis* or *virtus plastica*) in the sixteenth and seventeenth centuries, and within the tradition of criticism of Descartes and the atomists, one can list numerous other names including those of Jacob Schegk,<sup>149</sup> Daniel Sennert, Johannes Kepler, Thomas Browne, Robert Hooke, Herbert of Cherbury, Kenelm Digby or Walter Charleton. For instance, Sennert, Kepler and Browne referred to this plastic power while interpreting the

<sup>140</sup> Mosheim, *Systema intellectuale* 148–149.

<sup>141</sup> Cudworth, *The True Intellectual System* 171.

<sup>142</sup> Harvey, *Exercitationes* Ex. 49, 142–148; cf. Gilson E., *Études sur le rôle de la pensée médiévale dans la formation du système cartésien*, *Études de philosophie médiévale* 13 (Paris: 1967) 51–101; cf. Lotti, *Ralph Cudworth* 234.

<sup>143</sup> 'fundamentum vitae, princeps omnium, microcosmi sol, a quo omnis vegetatio dependet' – Harvey W., *Exercitationes anatomicae de motu cordis et sanguinis circulatione*. London: Roger Daniels, 1661, dedicatory letter to King Charles I.

<sup>144</sup> See note 6.

<sup>145</sup> Lotti, *Ralph Cudworth* 234.

<sup>146</sup> Harvey, *Exercitationes* Ex. 49, 142–143.

<sup>147</sup> Harvey, *Exercitationes* Ex. 10, 31–32; 50, 151; cf. Carré, *Phases of Thought* 213–214.

<sup>148</sup> For the medical tradition in Cambridge and its main lines of evolution in the seventeenth century, see Carré, *Phases of Thought* 213–214.

<sup>149</sup> The influence of Aristotle was nevertheless often complemented by that of Galen or of the Neoplatonists. E.g., for Schegk's inspiration in Galen and the Neoplatonists in his *De plastica seminis facultate*, see Hirai H., "The Invisible Hand of God in Seeds: Jacob Schegk's Theory of Plastic Faculty", in *Early Science and Medicine* 12 (2007) 377–404.

regular structure of the crystals as a product of an inner formative principle in the minerals.<sup>150</sup> Harvey himself quoted Sennert on the *facultas formatrix* as an efficient cause in the formation of the chick in the egg.<sup>151</sup> And, as shown above, Cudworth quoted Harvey. This made him part of a strong contemporary tradition of Aristotelianism and science, in addition to being a well-known Cambridge Platonist, while at the same time slotting into a long tradition of anti-Cartesian thought. The Aristotelian ideas referring to plastic nature thus appear to gain even more importance for Cudworth, as they are borrowed from a scientist whom he reveres.

However, as already suggested, Cudworth does not fully take on board the concept of plastic nature and physiology he finds in Harvey. First, he does not consider plastic nature as necessarily related to physiology, since for him they may be actually opposed, physiology being mainly mechanically conceived. In addition, Cudworth does not accept the immanentism of Harvey, nor does he seem interested in the Aristotelian difference between actual and potential that Harvey often mentions. What helps, to some extent, to solve the incongruities noted in Cudworth's concept of plastic nature is nevertheless the idea of the Aristotelian vegetative soul that he may have borrowed from Harvey. Resembling the vegetative soul, plastic nature could indeed be just a 'power' or 'faculty' of the soul, totally deprived of awareness. However, its function in the 'intellectual system', and especially at the macrocosmic level, must now be discussed.

#### i) *The hermetic and alchemical tradition and the vegetative soul*

In addition to his quotations from Aristotle's biological works, the Hippocratic and Galenic medical tradition, *Timaeus* and *The Laws* and, above all, from the *Enneads* of Plotinus and the works of Harvey, Cudworth also occasionally mentions the hermetic and alchemical tradition, which may provide an important key to understanding his concept of plastic nature. It was far from unusual in the seventeenth century to combine authors as different, for instance, as Aristotle, Aquinas, Duns Scotus, the Neoplatonists and Pseudo-Dionysius, while taking many of their ideas from Cornelius Agrippa's *De occulta philosophia*.<sup>152</sup> Cudworth himself may have borrowed ideas on the vegetative soul and plastic nature from the hermetic and alchemical

<sup>150</sup> Lotti, *Ralph Cudworth* 203–228.

<sup>151</sup> Harvey, *Exercitationes* Ex. 49, 143.

<sup>152</sup> Carré, *Phases of Thought* 198–199.

tradition and especially from Agrippa.<sup>153</sup> For instance, he refers to 'that nature of Hippocrates that is the *curatrix* of diseases' and to 'that Archeus of the chimists or Paracelsians to which all medicaments are but subservient'. For him these seem to represent precisely that principle in the bodies of animals mentioned above 'which is not mechanical but vital'. Here he combines these hermetic and alchemical notions with the ideas of Aristotle, who considers such a principle to be 'a certain part of the soul of those animals or a lower unconscious power lodged in them'.<sup>154</sup>

Likewise, Cudworth apparently borrows the idea of the vegetative soul presented in *De anima* 2.4 (415a23–25) as that which deals with nutrition (*trophê*) and generation (*genesis*), an idea taken up by Galen when he explains that feeling and voluntary action are specific to animals, and growth and nutrition to plants, the former being considered the effects of the soul and the latter the effects of nature. But Cudworth also insists that the rational life 'ought to be accounted a much higher and more noble perfection' than that of the plastic nature which is 'indeed the last and lowest of all lives', just as the vegetative is inferior to the sensitive.<sup>155</sup> It is in such passages that Cudworth finally responds to a question he should perhaps have posed much earlier if we are to better understand the status of the plastic nature. The idea is also found in Galen, who explains that, if one allows plants to have a share in the soul, then their soul would be called vegetative, while the other would be called sensory,<sup>156</sup> but Galen is not quoted here. And Cudworth does not draw such a distinction. For him, plastic nature is everywhere the same – both in the human soul and in the entire universe.

Perhaps, as already suggested, Cudworth took the idea from Harvey. Nevertheless, he prefers to cite the 'Platonists and Peripatetics' and 'the chimists and Paracelsians', who insist 'upon the same thing and seem rather to have carried the notion further on, in the bodies of animals, where they call it by a new name of their own, the Archeus'.<sup>157</sup> It should be added here that in Paracelsus, the Archaeus is a force of nature, the chief link between the 'blind matter' of which man is made and the personality that determines his 'complexion',<sup>158</sup> and in van Helmont the Archaeus

<sup>153</sup> Carré, *Phases of Thought* 266–167.

<sup>154</sup> Cudworth, *The True Intellectual System* 167.

<sup>155</sup> Cudworth, *The True Intellectual System* 163.

<sup>156</sup> Galen, *De fac. nat.* 1.1 (2.10–11 K.).

<sup>157</sup> Cudworth, *The True Intellectual System* 153; see also the explanations in Mosheim, *Systema intellectuale* 161.

<sup>158</sup> Cf. Prachter H.M., *Paracelsus. Magic into Science* (New York: 1951) 138.

consists of the connection of vital aura as material with the seminal image that is the inner spiritual nucleus.<sup>159</sup> Such ideas are not far from what Cudworth had already suggested and, indeed, we find Paracelsus' *De matrīce* and *De tribus principiis* in Cudworth's library.<sup>160</sup> Van Helmont's *Ortus medicinae* and his *Paradoxal Discourses* are also included<sup>161</sup> together with Cornelius Agrippa's *De occulta philosophia*.<sup>162</sup> It is thus possible that Cudworth borrowed the idea of the upper and lower elements from the hermetic tradition and from the Paracelsian corpus, although the idea of the role in the generation of animals of *semina* fallen from heaven to earth could have come from Anaxagoras himself.<sup>163</sup> A possible source for Cudworth's plastic nature could even be the hermetic notion of prime matter, not as matter in the sense accepted nowadays, but as the spiritual medium in and from which the world was created and also as a homogeneous and formless medium into which forms are introduced through creation.<sup>164</sup> But that would raise further problems and distinctions that are outside the scope of this article and would make us come full circle towards the immanentism that Cudworth often refutes.

### Conclusion

To summarise, while opposing physiology as mechanically conceived, Cudworth replaces it with the concept of plastic nature which, while it may be the lowest of all forms of life, since it is nevertheless life, must also necessarily be incorporeal. At the level of both the macrocosm and the microcosm, this plastic nature is responsible for order and regularity as marks of the incorporeal, intellectual principles guiding Cudworth's 'intellectual system of the universe'. However, it is described simply as a sign of the intellect in the corporeal world and not as capable of knowledge or awareness itself; this creates incongruities if one tries to fit this

<sup>159</sup> Cf. Thorndike L., *A History of Magic and Experimental Science*, VII–VIII: The Seventeenth Century (New York: 1958), vol. VII, 21.

<sup>160</sup> *Bibliotheca Cudworthiana sive catalogus variorum librorum plurimis facultatibus Insignium bibliothecae instructissimae Rev. Doct. Dr. Cudworth*, ed. Edward Millington (London: 1690/1691) 34.

<sup>161</sup> *Bibliotheca Cudworthiana* 40.

<sup>162</sup> *Bibliotheca Cudworthiana* 32.

<sup>163</sup> Mosheim, *Systema intellectuale* 161; cf. Pagel W., "The Higher Elements and Prime Matter in Renaissance Naturalism and in Paracelsus", in Winder M. (ed.), *Religion and Neoplatonism in Renaissance Medicine* (London: 1985) 93–127, esp. 94.

<sup>164</sup> Pagel, "The Higher Elements" 110–113.

concept of plastic nature within Cudworth's Platonic intellectual system of the universe.

In fact, Cudworth works so hard to refute Descartes' definition of being as cogitation and self-awareness that he does not seem to notice that he is also sometimes inconsistent with his Platonic/Neoplatonic, Aristotelian or Stoic sources, or at least that he quotes them in a fragmentary way. For instance, while motion may be interpreted as a sign of life, order may be a sign of the intellect and, by denying cogitation and self-awareness in his plastic nature, Cudworth partially disregards the Platonic and Neoplatonic principle of the *anima mundi* (world soul), the formal constitutive principle of the universe. In this respect, he prefers Aristotle's vegetative soul and insists that not everything that transcends mechanism has the ability to reach the level of knowledge by virtue simply of not being mechanical. Furthermore, he uses the ideas of Harvey on generation and organisation in the body and the universe as well as Stoic, Neoplatonic and Aristotelian sources common to both him and Harvey, but he avoids the monism and immanentism in Harvey, also found in the Stoics. This is due to his theological views, which prevent him from accepting the immanence of the intellectual principle in nature. He also prefers to avoid explaining important concepts in Aristotle, Plotinus or Galen such as *energeia* (actuality) and *dunamis* (potentiality), although he indirectly refers to them in relation to his plastic nature. Moreover, Cudworth's insistence on the inner activity (*energeia*) of nature, borrowed from Aristotle, is difficult to explain since he generally tends to define nature, on the contrary, primarily as *dunamis* (potentiality), according to the Neoplatonics, and as *hexis* (disposition), according to the Stoics. But this too is due to his preference for Aristotle's vegetative soul. One remaining question is whether such a concept of the vegetative soul can fit into his Platonic intellectual system: the answer is that it can, but not always.

Undoubtedly, all these issues have a serious impact on the clarity of his argument. His eclectic (or rather syncretic) manner makes him sometimes contradict the premises of his intellectual system while leaving out important views that would help him solve such contradictions. Thus, Cudworth seems to sacrifice the clarity and completeness of his arguments to his Renaissance ideal of the *prisca theologia* and to his attempt to find concordance and harmony between different ancient schools of thought.

The distinctions Cudworth makes are those between creation or life (*vis creatrix*) and generation or organisation (*vis generatrix*), between incorporeal or immaterial and corporeal or material, between action and



passion, between formal cause and material cause or between dynamic and mechanical. But he does not mention Aristotle's and Plotinus' distinction between *dunamis* (potentiality) and *energeia* (actuality) and that, together with his omission of the Stoic *pneuma* or the Platonic *anima mundi*, in fact provides an important explanation for the incongruities or gaps in his system. Under such conditions, the metaphor of the sleeping musician remains difficult to understand within Cudworth's wider 'intellectual' context. Perhaps because of his disagreements with Descartes, Cudworth is not interested in the potential/actual difference, but only in the corporeal/incorporeal difference in Aristotle. This may be due to him taking the ideas of Aristotle that had already been quoted or discussed by Harvey in terms of the Aristotelian medical tradition, making him overlook the potential/actual distinction. However, the analysis of Harvey's text shows that Harvey is very much aware of it and willing to discuss it, while Cudworth prefers to remain silent about it. A better answer then would be the following: had Cudworth discussed such a distinction and the concepts of the Stoic *pneuma* or the Platonic *anima mundi* at the same time, the concordance between his sources would have been threatened. But that makes him unable to account for his assertion that plastic nature 'mediates' between the intellectual and the sensible level both in the individual and in the universe. If plastic nature is just vegetative soul, which is below sensation or perception and below the level of actualising a certain potentiality, how can it mediate between the intellectual and the sensible realms?

Thus, when introducing plastic nature as a mediating term between the incorporeal and the corporeal, or between the intelligible and the sensible, Cudworth contradicts 'Ockham's razor', the principle of parsimony according to which one should not unnecessarily multiply the entities in an argument. All his arguments on plastic nature certainly help him to refute mechanical physiology, but they do not always assist in completely and accurately explaining the lack of awareness and knowledge of the plastic nature within his system, even according to the definitions he himself gives to it. Here, as elsewhere in his treatises, Cudworth sometimes leaves the argument only partially developed, preferring to remain an erudite who appeals to a multitude of ancient sources, among them Aristotle, Plotinus, the Stoics and Galen, and also to contemporary ones such as Harvey, together with the Aristotelian medical tradition supporting his work, and the hermetic and alchemical tradition of the time. The metaphor of the sleeping musician remains ambiguous, its main role apparently being only to avoid asserting a second rational and active principle

in addition to God himself, while at the same time refuting mechanism on one side and the immanence of the spiritual principle on the other side. Very helpful here, nonetheless, are the references in Harvey and also in Cudworth to the Aristotelian concept of the vegetative soul. As this paper has shown, they actually explain to some extent the status of the plastic nature.

*Selective bibliography*

- ARISTOTLE, *De anima*: eds. Ross W.D. et alii, *The Works of Aristotle* (Oxford: 1961), vol. 3.  
 —, *De generatione animalium*: eds. Ross W.D. et alii, *The Works of Aristotle* (Oxford: 1972), vol. 5.  
 —, *De partibus animalium*: eds. Ross W.D. et alii, *The Works of Aristotle* (Oxford: 1972), vol. 5.  
 —, *Physica*, ed. Ross W.D. (Oxford Classical Texts) (Oxford: 1977).  
 Bibliotheca Cudworthiana sive catalogus variorum librorum plurimis facultatibus Insignium bibliothecae instructissimae Rev. Doct. Dr. Cudworth, ed. Edward Millington (London: 1690/1691).  
 BONIFAZZI C., *The Soul of the World. An Account of the Inwardness of Things*. (Washington, D.C.: 1978).  
 CARRÉ M.H., *Phases of Thought in England* (Oxford: 1949) [repr. Westport Conn. 1972].  
 CASSIRER E. *The Platonic Renaissance in England*, tr. Pettegrove J.P. (Edinburgh: 1953).  
 COLISH M.L., *The Stoic Tradition from Antiquity to the Early Middle Ages*, 2 vols. (Leiden: 1985).  
 CUDWORTH RALPH, *A Sermon Preached Before the Honourable House of Commons on March 31, 1647, being a Day of Public Humiliation* (Liverpool, Thomas Hodgson-London, Edmund Fry: 1831).  
 —, *A Sermon Preached to the Honourable Society of Lincoln's Inn* (London, printed by J. Flesher for R. Royston: 1664).  
 —, *A Treatise Concerning Eternal and Immutable Morality with A Treatise of Free Will*, ed. Hutton S. (Cambridge: 1996).  
 —, *The True Intellectual System of the Universe* (London, Royston: 1678) [facsimile repr. Stuttgart: 1964].  
 DUHOT J.-J., *La conception stoïcienne de la causalité* (Paris: 1989).  
 GALEN, *De naturalibus facultatibus*: tr. Brock A.J. (1916), *On the Natural Faculties* (Cambridge, MA [repr. 1991]).  
 —, *De usu partium libri XVII*: ed. Helmreich G. (Leipzig: 1909).  
 GILSON E. *Études sur le rôle de la pensée médiévale dans la formation du système cartésien* (Paris: 1967) [Études de philosophie médiévale 13].  
 HARVEY WILLIAM, HARVEY W., *Exercitationes anatomicae de motu cordis et sanguinis circulatione* (London, Roger Daniels: 1661).  
 —, *Exercitationes de generatione animalium, quibus accedunt quaedam de partu, de membranis ac humoribus uteri et de conceptione* (London, Du Gardianis: 1651).  
 HIRAI H., "The Invisible Hand of God in Seeds: Jacob Schegk's Theory of Plastic Faculty", *Early Science and Medicine* 12 (2007) 377–404.  
 HUNTER W.B., *The Seventeenth-century Doctrine of Plastic Nature* (Cambridge: 1950).  
 HUTTON S., "Aristotle and the Cambridge Platonists: the Case of Cudworth", in Blackwell C. – Kusukawa S. (eds.), *Philosophy in the Sixteenth and Seventeenth Centuries. Conversations with Aristotle* (Aldershot, Hampshire: 1999) 337–349.  
 ISNARDI PARENTE M., *Techne. Momenti del pensiero greco da Platone al Epicuro*, Biblioteca di Cultura 76 (Florence: 1966).  
 JANET P., *Essai sur le médiateur plastique de Cudworth* (Paris: 1860).  
 KUCHARSKI P., "Sur l'évolution des méthodes du savoir dans la philosophie de Platon", in Kucharski P. (ed.), *Aspects de la spéculation platonicienne* (Paris-Louvain: 1971) 259–272.  
 KULLMANN W., *Die Teleologie in der aristotelischen Biologie. Aristoteles als Zoologe, Embryologe und Genetiker*, Sitzungsberichte der Heidelberger Akademie der Wissenschaften: Philosophisch-historische Klasse 1979, 2 (Heidelberg: 1979).  
 LOTTI B. *Ralph Cudworth e l'idea di natura plastica* (Udine: 2004).

- MOSHEIM JOHANN LORENZ VON, *Systema intellectuale huius universi seu de veris naturarum originibus comentarii* (Jena, Meyer: 1733) [Lat. translation and edition of Cudworth's *True Intellectual System of the Universe*].
- PAGEL W., "The Higher Elements and Prime Matter in Renaissance Naturalism and in Paracelsus", in Winder M. (ed.), *Religion and Neoplatonism in Renaissance Medicine* (London: 1985) 93–127.
- , "The Reaction to Aristotle in Seventeenth-Century Biological Thought: Campanella, van Helmont, Glanvill, Charleton, Harvey, Glisson, Descartes", in Underwood A. (ed.), *Science, Medicine and History. Essays on the Evolution of Scientific Thought and Medical Practice Written in Honour of Charles Singer* (London: 1953), vol. 1, 489–509.
- , *William Harvey's Biological Ideas. Selected Aspects and Historical Background* (Basel-New York: 1967).
- PAPY J. "Lipsius, Atoms and Pneuma? Stoic Physics and the Neostoic Reading of the World", in Hirai H. – Papy J. (eds.), *Justus Lipsius and Natural Philosophy. Handelingen van de Contactfora, KVAB* (Brussels: 2009) 11–19.
- PLATO, *Timaeus*: tr. Bury R.G., Loeb Classical Library 234 (Cambridge MA: 1989).
- PLOTINUS, *Enneades*: tr. Armstrong A.H. (1966–1988), *The Enneads*, The Loeb Classical Library, 7 vols., Cambridge, Mass.-London.
- PRACHTER H.M., *Paracelsus. Magic into Science* (New York: 1951).
- ROSS W.D., *Aristotle* (London: 1923; reprint London: 1960).
- SAMBURSKY S., *Physics of the Stoics* (New York: 1959).
- SOLMSEN F., "The Teleological Approach", in Solmsen F. (ed.), *Plato's Theology* (Ithaca-New York: 1942) 98–122.
- Stoicorum Veterum Fragmenta*: ed. Arnim I. von, 3 vols. (Stuttgart: 1903–1905) [reprint 1964].
- THORNDIKE L., *A History of Magic and Experimental Science, VII–VIII, The Seventeenth Century* (New York: 1958).
- TODD R.B., "Monism and Immanence: The Foundations of Stoic Physics", in Rist J.M. (ed.), *The Stoics* (Berkeley: 1978) 137–160.
- ZEKL H.G., *Aristoteles' Physik. Vorlesung über Natur*, Philosophische Bibliothek 380 (Hamburg: 1987).

## INDEX LOCORUM

### *Biblical passages*

<i>John</i>		<i>Mark</i>	
5.1-8	316	5	311
9.1-4	316	5.24-34	309
<i>Leviticus</i>		5.24b-34	307, 309
12.7	312	5.25	311
15.19-33	312	5.28-30	314
17	428	5.29	312
17.11	415, 420	<i>Matthew</i>	
20.18	312	9.19-22	309
<i>Luke</i>		15.22	316
8	311	<i>Numbers</i>	
8.42-48	309	5.1-4	311
8.44-46	314		
13.10-17	316		
22.44	509		

### *Classical passages*

<i>Aëtius</i>		416b	370 n. 28
<i>Placita</i>		417b6, 16	725 n. 57
4.3.11	88 n. 15	418a-b	555 n. 18
4.13	554 n. 14	419a	556 n. 19
4.15.3 (= SVF II		420b6	695
866)	558 n. 27	420b34	695
<i>Agnellus Ravennas</i>		424a5	725 n. 59
<i>In Galeni De sectis commentarium</i>		424a18	725 n. 60
5, 24 Westerink	32 n. 20	430a	723
26, 26 Westerink	644 n. 49	431a	724 n. 54
<i>Aristoteles et Corpus Aristotelicum</i>		431b29-31	676
<i>Analytica posteriora</i>		432a	723
76a37-40	44	432a16	725 n. 59
98a20-23 (2.14)	44 n. 10	<i>De caelo</i>	
99a15-16 (2.17)	44 n. 10	271a33	728 n. 75
<i>De anima</i>		288b15-20	256 n. 61
402a-402b	600 n. 27	<i>Ethica Nicomachea</i>	
405a30	677 n. 42	1096b29	566 n. 68
409a7-10	98 n. 46	1098b33	739
409a7	98 n. 47	<i>De generatione animalium</i>	
411b19-22	98 n. 46	725b	371 nn. 32-33
413b16-21	98 n. 46	725b-726a	371 n. 31
416a	370 n. 29	726a	370 n. 30
		736b30ff.	145 n. 19
		739b20	456 n. 44

(Arist. et Corpus Arist. *cont.*)

740b-741a	371 n. 34
741a	371 n. 35
744b-745b	366 n. 9, 371 n. 36
766b	370 n. 30
777a15	450 n. 22
783b7-8	245 n. 20
784b7f.	245 n. 15
784b8-10	245 n. 16
784b33-34	257 n. 62
785a26-30	245 n. 16
789a8-b15	715 n. 13

*De generatione et corruptione*

314a-314b	369 n. 23
319b	369 n. 25
319b-320a	369 n. 24
322a	370 n. 26

*Historia animalium*

486b19-22	43
488b12-27	91 n. 27
518a8-18	245 n. 16
536b24-32	94 n. 37

*De iuventute*

469b32-470a4	250 n. 38
470a1	245 n. 15
470a23-b5	52 n. 35

*De longaeuitate*

466a12-17	243 n. 6
466a27-28	244 n. 11
466a30-33	249 n. 34
466b13-14	244 n. 11
466b17-19	245 n. 13

*Metaphysica*

1022b	738
1048a35-37	52

*Meteorologica*

341b6-10	50 n. 29
351a26-27	51 n. 31
356b9-12	49
357a24-28	49
357a32-b1	52 n. 39
357b21-26	50
357b24-26	49 n. 27
357b24-358a26	50
358a3-25	49 n. 27
360a6-8	50 n. 30
366b14-19	48 n. 24
366b14-22	58 n. 59
366b19-30	49 n. 25
368a6-11	58 n. 59
379a17-19	250 n. 38
379b12-34	462 n. 63
379b33-380a9	144 n. 18

*De partibus animalium*

639b16-21	728 n. 72
644a16-23	44 n. 7
650a21-25	50 n. 31
650b	296
654b-655a	376 n. 51
665a-667b	433 n. 48
668b	507 n. 24, 509 n. 31
671b3-24	105 n. 2
672b14-19	51 n. 33

*Physica*

191b-192b	665 n. 11
192b8-193b21	731
194b16-195b30	727
195a21-27	727
196b17-25	728 n. 74
199b26-33	730-731
246b2	725 n. 58
415a23-25	744

*Poetica*

1457b6	43 n. 3
1457b6-33	43
1457b7-16	45
1457b20-22	45

*Problemata*

874b33	245 n. 14
875a4-15	245 n. 15
875a15	247 n. 26
909b2	245 n. 18
909b25-27	245 n. 18

*De respiratione*

474b13-24	245 n. 15
475b18-20	163 n. 80
478a15-25	163 n. 80
478b27-28	244 n. 10

*Rhetorica*

1410b12-15	43, 46
1410b36	43 n. 3

*De sensu*

437b	555 n. 17
437b26-35	554 n. 13
438a	555 n. 16

*Topica*

108a11	551, 566 n. 68
--------	----------------

*Athenaeus**Deipnosophistae*

3.101a	29 n. 5
6.324	297 n. 3

*Celsus**De medicina*

7.7.14a	562 n. 47
---------	-----------

- Chrysippus apud Plutarchum  
*De Stoicorum repugnantiiis*  
 1052F 635  
 Cicero  
*De natura deorum*  
 2.25 (65) 148 n. 30  
 Clemens Alexandrinus  
*Protrepticus*  
 2.36.1 498 n. 70  
 Diogenes Laertius  
*De clarorum philosophorum vitis*  
 7.148 734 n. 103  
 8.10 247 n. 28  
 10.42 57 n. 51  
*Didascalica Apostolorum*  
 26.62.5 313 n. 14  
 Dionysius Alexandrinus  
*Epistola Canonica ad Basilidem episcopum,*  
*Canon II: Migne*  
 1282 313 n. 15  
 Epicurus  
*Epistula ad Herodotum*  
 2.63 88 n. 15  
 10.42 57 n. 51  
 37-38 46  
 58-59 47  
 63 88 n. 15  
*Epistula ad Pythoclem*  
 10.105 54 n. 43  
*De rerum natura*  
 28.5 43 n. 3  
*Sententiae Vaticanae*  
 24 93 n. 33  
 Eustathius  
*Commentarii ad*  
*Homeri Iliadem*  
 1.738.26-1.738.29 ad 4.237 495 n. 61  
 2.74.13-2.75.15 ad 5.289 498 n. 68  
*Commentarii ad*  
*Homeri Odysseam*  
 1.104.8 ad 2.376 493 n. 49  
 Galenus et Corpus Galenicum  
*An in arteriis natura sanguis contineatur*  
 2 (4.706-707 K.) 635 n. 18  
 8 (4.733 K.) 640  
*De anatomicis administrationibus*  
 7.16 (2.646-650 K.) 640  
*De atra bile*  
 2 (5.107 K.) 297 n. 7  
*De causis pulsuum*  
 2.10 (9.86 K.) 31 n. 18  
 2.13 (9.89 K.) 31 n. 18  
 3.6 (9.129 K.) 250 n. 37  
*De constitutione artis medicae*  
 1 (1.227 K.) 30 n. 14  
*De differentiis febrium*  
 1.10 (7.318 K.) 247 n. 26  
*De differentiis pulsuum*  
 4.3 (8.721 K.) 30 n. 14  
*De elementis secundum Hippocratem*  
 1.5 (1.449 K.) 31 nn. 15-16  
 1.9 (1.486 K.) 31 n. 15  
 2.2 (1.494-495,  
 142, I-6 K.) 665 n. 9  
 2.2 (1.496 K.) 297 n. 5  
 2.2 (1.497 K.) 297 n. 6  
*De facultatibus naturalibus*  
 1.1 (2.10-11 K.) 744 n. 156  
 1.4 (2.9 K.) 110 n. 15  
 1.5 (2.152 K.) 732 n. 95  
 1.12 (2.27 K.) 87 n. 11  
 1.13 (2.36-37 K.) 109 n. 13  
 1.14 (2.45 K.) 31 n. 15  
 1.15 (2.59 K.) 106 n. 7  
 1.16 (2.65-66 K.) 106 n. 7, 107 n. 8,  
 107 n. 10  
 2.2 (2.78-79 K.) 108 n. 12  
 2.3 (2.80 and  
 101 K.) 638  
 2.3 (2.80 K.) 108 n. 12  
 2.4 (2.88 K.) 30 n. 12, 31 n. 15  
 2.4 (2.88-92 K.) 31 n. 15  
 2.9 (2.117 and  
 129 K.) 633 n. 10  
 3.13 (2.201 K.) 639  
 4 (2.88-92 K.) 30 n. 12  
*De foetuum formatione*  
 6 (4.689 K.) 30 n. 14  
*Historia philosopha*  
 25 (19.306-307 K.) 553 n. 8, 554 n. 11  
*De iuvamentis membrorum*  
 6.3 110 n. 16  
*De libris propriis*  
 17 (19.48 K.) 31 n. 19  
 (SM II, 97 = Boudon-  
 Millot 140.18) 551 n. 2  
*De locis affectis*  
 4.1 (8.217.1-2 K.) 564 n. 55  
 4.1 (8.218.3-8 K.) 564 n. 56



(Galenus et Corpus Galen. *cont.*)

- 4.1 (8.218.10–12 K.) 564 nn. 57, 59  
 4.1 (8.221.15–18 K.) 564 n. 58  
 4.1 (8.226.2–11 K.) 565 n. 60  
 4.1 (8.227.3 K.) 565 n. 61  
 6.3 (8.396–398 K.) 109 n. 14

*De marcore*

- 2 (7.669–670 K.) 256 n. 60  
 3 (7.672–676 K.) 250 n. 37  
 4 (7.677–681 K.) 256 n. 59  
 4 (7.679 K.) 250 n. 39

*De methodo medendi*

- 1.2 (10.17 K.) 31 n. 15  
 2.5 (10.107 K.) 30 n. 14, 31 nn. 16, 18  
 9.10 (10.635 K.) 638  
 10.11 (10.730 K.) 256 n. 59  
 11.8 (10.753 K.) 250 n. 37  
 12.5 (10.839–840 K.) 632 n. 9  
 14.3 (10.986–989 K.) 562 n. 47

*De optima doctrina*

- 5 (1.52.1–9 K.) 566 n. 68

*De ordine librorum suorum*

- (19.49–61 K.) 642 n. 39

*De partibus artis medicativae*

- 1 30 n. 13  
 6 30 n. 13

*De placitis Hippocratis et Platonis*

- 2.8 (5.281 K.) 636 n. 20  
 6.3 (5.520–521 K.) 640  
 6.3 (5.521 K.) 641  
 6.8 (5.572–573 K.) 637  
 7.3 (5.600–601 K.) 638  
 7.3 (601 K.) 638  
 7.4 (5.611 K.) 557 n. 25, 561 n. 41  
 7.4 (5.612 K.) 558 n. 26  
 7.4 (5.614 K.) 561 n. 43, 562 nn. 44, 48  
 7.4 (5.615 K.) 563 n. 51  
 7.4 (5.617 K.) 560 n. 35  
 7.5 (5.618 K.) 560 n. 37  
 7.5 (5.622 K.) 561 nn. 39–40  
 7.5 (5.625 K.) 560 n. 36  
 7.7 (5.703–704 K.) 250 n. 36  
 8.8 (5.707–709 K.) 637 n. 25  
 9.9 (5.792 K.) 31 n. 16  
 10.7 (5.707 K.) 637

*De propriis placitis*

- 8.3 638 n. 30  
 14 566 n. 67

*De sanitate tuenda*

- 1.2 (6.6 K.) 244 n. 10

- 1.12 (6.67 K.) 506 n. 11, 506 n. 12  
 4.4 (6.251 K.) 505 n. 5, 510 n. 46  
 4.4 (6.65f K.) 505 n. 6  
 6.2 (6.388 K.) 257 n. 62  
 6.3 (6.399–400 K.) 244 n. 10  
 6.8 (6.417f K.) 508 n. 28

*De semine*

- (4.512–651 K.) 366 n. 10

*De simplicium medicamentorum temperamentis ac facultatibus*

- 2.1 (11.445 K.) 31 n. 17  
 2.20 (11.517 K.) 31 nn. 16, 17, 18  
 4.14 (11.664 K.) 30 n. 14, 31  
 nn. 15–16  
 10.14 (12.281 K.) 504 n. 3, 505 n. 5  
 10.14 (12.282 K.) 505 n. 4

*De symptomatum causis*

- 1.2 (7.89 K.) 562 n. 44

*De temperamentis*

- 2.2 (1.580–582 K.) 248 n. 31  
 2.2 (2.582 K.) 243 n. 8

*De usu partium*

- 2.7 (3.117–118 K.) 732 n. 94  
 2.8 (3.121–125 K.) 732 n. 94  
 2.9 (3.167 K.) 550, 732 n. 94  
 3.6 (3.760 K.) 559 n. 31  
 4.3 (3.269–270 K.) 633 n. 10  
 5.5 (3.363 K.) 106 n. 5  
 5.6 (3.371–373 K.) 107 n. 9  
 5.7 (3.373 K.) 106 n. 6  
 6.16 (3.487 K.) 637  
 7.8 (3.541 K.) 30 n. 14  
 7.8 (3.541–542 K.) 633 n. 12  
 8.6 (3.641.6 K.) 551 n. 2  
 8.6 (3.644.2–3 K.) 559 n. 33  
 10.1 (3.760, 14–761, 1 K.) 563 n. 53  
 10.1–2 (3.759–769 K.) 551 n. 1  
 10.2 (3.762.7 K.) 559 n. 32  
 10.5 (3.781 K.) 562 n. 44, 563 n. 54  
 10.5 (3.782.13–16 K.) 562 n. 45, 559 n. 34  
 10.12 (3.812.15 K.) 566 n. 66  
 10.12 (3.813–814 K.) 562 n. 49  
 10.12 (3.817.7–8 K.) 558 n. 29  
 11.14 (3.905 K.) 31 n. 15

*Definitiones medicae*

- 11 (19.351 K.) 5 n. 14, 29 n. 6  
 72 (19.365 K.) 507 n. 22

- 73-74 (19.365-366 K.) 642 n. 36  
 117 (19.379, 10-14 K.) 556 n. 22  
*Historia Philosphia*  
 (19.306.16 K.) 554 n. 11  
 (19.306-307 K.) 553 n. 8  
*In Hippocratis librum De alimento commentarii*  
 3 (15.262 K.) 298 n. 8  
 3.17 (15.322f K.) 505 n. 8  
 3.17 (15.322 K.) 506 nn. 15-16  
*In Hippocratis Aphorismos commentarii*  
 1.15 (12.421 K.) 506 n. 15  
 1.15 (17B.420f K.) 506 n. 11  
 3.30 (17B.645 K.) 249 n. 32  
 14 (17B, 408-409 K.) 250 n. 37  
 14 (17B.410-412 K.) 245 n. 19  
*In Hippocratis librum De articulis commentarii*  
 45 (18A.379 K.) 67 n. 3  
*In Hippocratis Epidemiarum librum VI commentarii*  
 1.2 (17A.805 K.) 31 nn. 16, 18  
 4.10 (17B.161 K.) 30 n. 14  
 4.19 (017B.189 K.) 30 n. 14  
*In Hippocratis librum De fracturis commentarii*  
 2.9 (18b.435.7-10 K.) 485 n. 11  
*In Hippocratis De humoribus librum commentarii*  
 2.1 (16.216f K.) 511 n. 48  
 2.1 (16.217 K.) 510 n. 46  
*In Hippocratis De natura hominis librum commentarii*  
 1 (15.73-74 K.) 298  
 3.7 (15.185-190 K.) 248 n. 31  
*Introductio seu medicus*  
 2 (14.677-678 K.) 29 n. 10  
 7 (14.689-690 K.) 29 n. 8  
 8 (14.695 K.) 29 n. 10  
 16 (14.767-777 K.) 552 n. 3  
*Thrasylbulus sive utrum medicinae sit an gymnasticae hygiene*  
 30 (5.862 K.) 31 n. 16  
 Gregorius Magnus *Epistola* 64: Migne  
 1194 313 n. 16  
 Hippocraticum Corpus  
*Aphorismi*  
 1.14 (4.466 L.) 247 n. 25  
*De carnibus*  
 8 (8.594 L.) 296  
*Epidemiae*  
 6.5 (5.315 L.) 735 n. 106  
*De flatibus*  
 8 (6.100-104 L.) 146 n. 23  
*De glandulis*  
 6 (8.560 L.) 129 n. 50  
*De humoribus*  
 11.1 (5.490 L.) 51 n. 34  
*De locis in homine*  
 30 (6.322 L.) 296  
*De morbis*  
 2.8 (7.16 L.) 296  
 4.51 (7.584 L.) 296  
*De morbo sacro*  
 7 (6.372 L.) 634 n. 16  
 10 (6.378 L.) 296  
 16 (6.390-392 L.) 634 n. 16  
*De natura hominis*  
 12 (6.64 L.) 247 n. 25  
 Homerus  
*Ilias*  
 3.35 497  
 3.142 496  
 4.130 485 n. 10  
 4.137 485 n. 10  
 4.139 485 n. 10, 496  
 4.237 485 n. 10, 491, 496  
 4.447 488 n. 24  
 4.510 485 n. 10, 491  
 4.511 491  
 5.308 488  
 5.335-346 498 n. 69  
 5.337 485 n. 10, 496  
 5.354 485 n. 10, 496  
 5.696 493  
 5.855-861 498 n. 69  
 5.858 485 n. 10, 491, 496  
 6.117 486 n. 14  
 7.207 485 n. 10  
 7.474 488 n. 24  
 8.43 485 n. 10  
 8.61 488 n. 24  
 8.298 485 n. 10, 491, 496  
 9.548 486 n. 14  
 9.596 485 n. 10  
 10.23, 10.177 486 n. 14  
 10.155 488 n. 24  
 10.212 499 n. 75  
 10.262 488 n. 24  
 10.334 488 n. 24  
 10.575 485 n. 10  
 11.352 485 n. 10, 491

(Hom. *cont.*)

11.398 485 n. 10, 491  
 11.437 485 n. 10, 496  
 11.457 485 n. 10, 496  
 11.573 485 n. 10, 491, 496  
 11.574 485 n. 10, 491, 496  
 12.263 488 n. 24  
 12.427 485 n. 10, 496  
 12.464 485 n. 10  
 13.25 485 n. 10  
 13.191 485 n. 10  
 13.241 485 n. 10  
 13.279 485 n. 10, 497  
 13.284 485 n. 10, 497  
 13.340 485 n. 10, 491  
 13.406 488 n. 24  
 13.440 485 n. 10  
 13.501 485 n. 10, 491, 497  
 13.544 493  
 13.553 485 n. 10, 491, 496  
 13.574 485 n. 10, 496  
 13.580 493  
 13.616 488 n. 24  
 13.640 485 n. 10  
 13.649 485 n. 10, 496  
 13.804 488 n. 24  
 13.830 485 n. 10, 491, 495  
 13.831 496  
 14.25 485 n. 10  
 14.164 485 n. 10  
 14.170 485 n. 10, 491 n. 32  
 14.170–172 497 n. 65  
 14.175 485 n. 10  
 14.187 485 n. 10  
 14.383 485 n. 10  
 14.406 485 n. 10, 491  
 14.456 485 n. 10, 496  
 15.315 485 n. 10, 491, 496  
 15.316 485 n. 10, 491, 496  
 15.317 485 n. 10, 491, 496  
 15.534 485 n. 10  
 16.11 496  
 16.247 499 n. 75  
 16.341 486  
 16.504 485 n. 10  
 16.636 488 n. 24  
 16.678–680 498 n. 71  
 16.761 485 n. 10, 491, 497  
 16.814 485 n. 10, 496  
 17.210 485 n. 10  
 17.571 485 n. 10  
 17.733 485 n. 10, 497  
 18.344–351 498 n. 71

19.27 485 n. 10, 496  
 19.33 485 n. 10, 491, 498 nn. 71–72  
 19.38–39 498 n. 71  
 19.39 485 n. 10, 488 n. 24, 491  
 19.174 493 n. 52  
 19.233 485 n. 10  
 19.323 496  
 20.100 485 n. 10, 491, 496  
 20.276 488 n. 24  
 21.70 485 n. 10, 496  
 21.168 485 n. 10, 496  
 21.398 485 n. 10, 491, 496  
 21.568 485 n. 10, 491  
 21.568–569 498  
 22.286 485 n. 10, 496  
 22.321 485 n. 10, 491  
 22.322 485 n. 10  
 22.370–374 499 n. 73  
 23.67 485 n. 10  
 23.186–191 498 n. 71  
 23.191 485, 496  
 23.598 493 n. 52  
 23.600 493 n. 52  
 23.673 485, 496  
 23.803 485 n. 10, 491  
 23.805 485 n. 10, 491  
 23.819 485 n. 10  
 24.19 485 n. 10  
 24.19–21 498 n. 71  
 24.119 = 147 = 176 = 196 493 n. 52  
 24.321 493 n. 52  
 24.358 493  
 24.414 485 n. 10, 496, 498 n. 71, 499

*Odyssea*

1.108 488 n. 24  
 2.291 486 n. 14  
 2.376 485 n. 10, 492  
 4.436 486 n. 14  
 4.440 486 n. 14  
 4.749 485 n. 10  
 4.750 485 n. 10  
 4.759 485 n. 10  
 4.782 486 n. 14  
 4.840 493 n. 52  
 5.26 = 144 = 168 499 n. 75  
 5.160–161 492  
 5.281 488 n. 24  
 5.426 488  
 5.435 488  
 5.455 496  
 6.61 485 n. 10  
 6.129 485 n. 10  
 6.219–220 497 n. 65

- |            |                      |            |                |
|------------|----------------------|------------|----------------|
| 6.220      | 485 n. 10            | 19.263     | 485 n. 10, 491 |
| 6.224      | 485 n. 10            | 19.263–264 | 492            |
| 8.53       | 486 n. 14            | 19.320     | 497 n. 65      |
| 8.521–522  | 492, 494             | 19.505     | 497 n. 65      |
| 8.530      | 493 n. 47            | 19.536     | 494            |
| 8.530–531  | 492                  | 21.412     | 485 n. 10      |
| 8.541      | 493 n. 47            | 21.412–413 | 497            |
| 9.79       | 499 n. 75            | 22.59      | 493 n. 52      |
| 9.292–293  | 486                  | 22.88      | 493            |
| 10.359     | 493                  | 22.113     | 485 n. 10      |
| 10.450     | 497 n. 65            | 22.278     | 488            |
| 11.191     | 485 n. 10            | 22.362     | 486 n. 14      |
| 11.529     | 485 n. 10, 497       | 23.47      | 493 n. 52      |
| 11.535     | 499 n. 75            | 23.95      | 485 n. 10      |
| 12.45–46   | 488–489, 492 n. 42   | 23.115     | 485 n. 10      |
| 12.46      | 488                  | 23.237     | 485 n. 10      |
| 12.175     | 493                  | 24.44      | 485 n. 10      |
| 12.395     | 488 n. 24            | 24.156     | 485 n. 10      |
| 12.423     | 488 n. 24            | 24.158     | 485 n. 10      |
| 13.398     | 485, 496             | 24.467     | 485 n. 10      |
| 13.429–432 | 486                  | 24.500     | 485 n. 10      |
| 13.430     | 485, 496             |            |                |
| 13.436     | 486 n. 14            |            |                |
| 14.24      | 485 n. 10, 486 n. 14 |            |                |
| 14.50      | 486 n. 14            |            |                |
| 14.134     | 488                  |            |                |
| 14.255     | 499 n. 75            |            |                |
| 14.506     | 485 n. 10            |            |                |
| 14.519     | 486 n. 14            |            |                |
| 15.60      | 485 n. 10            |            |                |
| 15.165     | 493 n. 52            |            |                |
| 15.379     | 493 n. 52            |            |                |
| 16.145     | 485, 488, 492 n. 42  |            |                |
| 16.175     | 485 n. 10, 496       |            |                |
| 16.181–182 | 487                  |            |                |
| 16.182     | 485 n. 10            |            |                |
| 16.210     | 485 n. 10            |            |                |
| 16.332     | 496                  |            |                |
| 16.457     | 485 n. 10            |            |                |
| 17.48      | 485 n. 10            |            |                |
| 17.58      | 485 n. 10            |            |                |
| 17.203     | 485 n. 10            |            |                |
| 17.338     | 485 n. 10            |            |                |
| 18.172     | 485 n. 10, 497 n. 65 |            |                |
| 18.179     | 485 n. 10, 497 n. 65 |            |                |
| 18.192–193 | 497 n. 65            |            |                |
| 19.72      | 485 n. 10            |            |                |
| 19.136     | 493                  |            |                |
| 19.204     | 485 n. 10, 492       |            |                |
| 19.218     | 485 n. 10            |            |                |
| 19.232     | 485 n. 10            |            |                |
| 19.237     | 485 n. 10            |            |                |
- Johannes Alexandrinus  
*Commentaria in librum De sectis Galeni*  
 1, 11 Pritchett 32 n. 20  
 9, 50–51 Pritchett 644 n. 48  
*In Hippocratis Epidemiarum librum VI*  
*commentarii fragmenta*  
 CMG XI.1.4, 102,  
 1–4 Duffy 645 nn. 53–54  
 CMG XI.1.4,  
 Duffy 643 n. 42, 644 n. 48  
*In Hippocratis De natura pueri*  
*commentarium 1:*  
 CMG XI.1.4.132 32 n. 20
- Jonas Aurelianus Episcopus  
*De institutione laicali*  
 Migne  
 187–188 314 n. 18
- Lucretius  
*De rerum natura*  
 1.250 148 n. 30  
 2.1105–1174 56  
 2.1164–1174 56  
 3.231–322 87  
 3.262–265 88 n. 14  
 3.288–307 89 n. 20  
 3.307 92  
 3.307–322 92  
 3.314–318 91 n. 28  
 3.357–358 88 n. 14

- 3.487–509 58 n. 56  
 3.634–669 98 n. 45  
 3.741–753 90 n. 25  
 3.991–992 148 n. 30  
 4.110–122 98 n. 50  
 4.962–1036 92 n. 32  
 4.984–1010 93 n. 34  
 5.855–867 90 n. 25  
 6.495–503 55 n. 45  
 6.547–551 54 n. 44
- Macrobius  
*Commentarium in somnium Scipionis*  
 1.14.20 88 n. 15
- Origenes  
*Contra Celsum*  
 1.67–68 324 n. 32
- Palladius  
*Scholia in Galeni De sectis*  
 75 Baffioni 32 n. 20
- Plato  
*Timaeus*  
 29a 730 n. 85  
 30c 730 n. 85  
 31b–32c 400 n. 18  
 32c–33a 259 n. 67  
 34b–36d 403 n. 27  
 35b–36b 396 n. 10  
 36d–e 721 n. 41  
 36e 721 n. 42  
 37c 721 n. 41, 730 n. 85  
 42d 715 n. 15  
 45b–d 555 n. 15  
 47b–d 398  
 47d 403 n. 29  
 53c–55c 259 n. 67  
 55e 731 n. 88  
 70d–71a 410 n. 46  
 70d–72b 408 n. 45  
 70d–e 638  
 71a–b 410 n. 47  
 78d–78e 527 n. 16  
 79d–e 163 n. 80  
 81d 259 n. 67  
 85c–e 296  
 86e–f 88 n. 15  
 87–90 412 n. 52  
 90a–b 672 n. 28
- Plinius  
*Naturalis historia*  
 10.98.212 94 n. 38
- Plotinus  
*Enneades*  
 2.3.17 734 n. 101  
 3.2.16 729, 734 n. 102  
 4.4.13 734 n. 100  
 5.5.1 724 n. 54
- Plutarchus  
*Adversus Colotem*  
 118D–E 88 n. 15  
*Demetrius*  
 38.3–4 399 n. 14
- Pseudo-Plutarchus  
*Placita philosophorum*  
 883C4–5 484 n. 9  
 IV, 13, Lachenaud  
 154 553 n. 8  
 XII<sup>2</sup>, Lachenaud  
 15–18 553 n. 7
- Soranus  
*Gynaecia*  
 1.1.1 32 n. 20  
 1.1.2 29 n. 7, 32 n. 21  
 3.3.5 29 n. 7, 32 n. 21
- Pseudo-Soranus  
*Quaestiones*  
*medicinales* 23 32 n. 20
- Stephanus  
*In Hippocratis Aphorismos commentarii*  
 CMG XI.3.1.34 32 n. 20  
 CMG XI.1.3.2 645 n. 52  
*In Hippocratis Prognosticum commentarii*  
 CMG XI.1.2 644 n. 51
- Stobaeus  
 4.50.2 247 n. 25
- Stoicorum Veterum Fragmenta*: Arnim I.  
 von, 3 vols. (Stuttgart: 1903–1905) [reprint  
 1964].  
 1.85, 87, 102, 735 n. 111  
 153–154,  
 159–162, 493,  
 495  
 1.89–90 735 n. 112  
 1.134–143 216–223, 518–526, 737  
 n. 121  
 2.52.178 562 n. 47  
 2.299–328 526, 735 n. 111  
 2.341, 346a,  
 358–359, 467,  
 665, 797, 848

2.393, 458	635	Theophrastus	
2.716	635	<i>De causis plantarum</i>	
2.725	737 n. 120	6.2.3	554 n. 11
2.773-789,	737 n. 121	<i>De sensu</i>	
823-849		26	557 n. 24
2.806	635	49-83	554 n. 11
3.84	735 n. 112	50-54	554 n. 11
3.219-220,	737 n. 120	438	554 n. 11
337-339,		Vergilius	
367-376		<i>Georgica</i>	
3.544-656	737 n. 121	2.324-326	148 n. 30

## INDEX GENERALIS

- Abano, Pietro d', 33, 368 n. 20, 387–388  
 Aeschylus, 71, 497 n. 66  
 Aëtius, 553  
 Agathinus, 636 n. 23  
 Agnellus of Ravenna, 32, 644, 647 n. 61, 648 n. 62  
 Agrippa von Nettesheim, Heinrich  
     Cornelius, 150 n. 36, 697, 743, 745  
 Albinus, Bernard Siegfried, 213  
 alchemy, 139–159, 168, 255, 348, 463, 743–744, 747  
 Alcmaeon, 88 n. 15, 554 n. 14  
 Alderotti, Taddeo, 139, 386  
 Alexander of Aphrodisias, 96  
 Alexandria, 643, 647  
 Alexandrian school, 644  
 Alpago, Andrea, 348  
 Alpago, Paolo, 348  
 Alpetragius, 187  
 Amelung, Juliane, 607  
 Amsterdam, 74, 205, 579–580  
 amulet(s), 19, 308, 324–325, 328, 332, 334–335  
*Anatomia animata*, 202  
 anatomy  
     animal, 233  
     comparative, 10, 65, 69, 75–76, 78, 448  
     descriptive, 37  
     female, 460  
     functional, 65, 629, 633, 654  
     and physiology, 2, 4, 38, 103, 171, 173 n. 11, 221, 416  
     theatre(s), 3, 347, 581  
 Anaxagoras, 676, 745  
 Anaximenes, 634  
 Anguier, Michel, 280, 284  
 al-Anṭākī, Dawūd, 358  
 Antonio Palazzo, 182 n. 43  
*aquavit*, 142, 154, 156, 158–159, 168  
 Aquinas, Thomas, 743  
 Archigenes, 636 n. 23  
 Aretaeus, 124, 211  
 Aristophanes (comicus), 68  
 Aristophanes of Byzantium, 91 n. 26  
 Aristotelianism, 83, 96, 432, 715 n. 15, 743  
 Aristotle, 15 n. 39, 16, 31 n. 15, 68–69, 73, 76, 90 n. 22, 92 n. 29, 97–98, 145 n. 19, 148, 201 n. 19, 208, 213, 242, 253, 344, 369–370, 415, 432, 462, 507, 509, 526–527, 551, 573–574, 638, 671, 713–750  
     on ageing, 244–245, 249, 250, 256  
     and/on analogy, 10, 13, 18, 41–42, 44–45, 47–53, 58–59, 243–244, 369–371, 376 n. 51, 467, 673  
     and Avicenna, 369, 372–373, 380  
     biology of, 54, 91, 92 n. 29, 94  
     on blood and blood vessels, 296–297, 370, 438, 462, 507, 509  
     causality of, 727, 740–741  
     on digestion, 48–52, 144, 368, 370, 462–463  
     on earthquakes, 49, 59  
     on elements, 86, 100  
     on the embryo, 364, 366–368, 371–372, 379, 467, 673  
     on generation, 368–370, 372, 386, 456  
     on growth, 368–369, 456  
     on the heart, 358, 433, 437  
     on the kidneys, 105–106, 123 n. 40, 130  
     and Lucretius, 86 n. 8, 90, 94–95, 98–99  
     on matter, 345, 369, 665  
     on menstrual blood, 370, 450, 456, 462  
     and/on metaphor, 43–47, 57, 249, 379–380  
     on meteorology, 47–48, 52–53  
     on motion, 189, 190 n. 70  
     on nutrition, 368, 372–373, 386, 456  
     psychology of, 49–51, 368, 370, 667, 669, 677, 695, 713–750  
     on semen, 370, 462  
     on *sensus communis*, 203, 600 n. 27  
     sexism of, 332, 364, 457 n. 46  
     teleology of, 54, 92 n. 29, 715, 719, 726–738  
     on vision, 551, 554–556, 566, 569, 573–575, 591–592  
     on the voice, 695, 702  
 artery, -ies, 72, 201, 212, 347–349, 365, 376, 404–408, 435, 453–454, 458, 461, 464 n. 70, 469–471, 610, 639–640, 718  
     as carriers of innate heat and vital spirit(s), 143 n. 14, 347, 427–428, 433–435, 458, 466, 529, 630, 632–633, 637–640, 648, 650



- Galen on, 637, 639–640, 654  
 pulsation of, 126 n. 46, 434–435, 638  
 renal, 103, 105–106, 112–113, 115, 118–119,  
 125, 127, 130, 132–133  
 (arterial) vein, 347, 349  
*Articella*, 629, 649  
 Asclepiades, 30–31  
 Asclepius, 321, 552  
 Aselli, Gaspare, 65, 73, 74, 468, 469, 470  
 Asterius of Amasia, 324  
 Athenaeus, 30, 69, 296  
 atoms, 47, 55 n. 45, 85, 87, 93, 96, 97 n. 43,  
 98, 100, 224–225, 715, 729  
 atomism, 16, 83, 84, 85 nn. 6, 8, 88, 92,  
 95, 97 nn. 42–43, 98, 234, 472, 634,  
 714, 732  
 al-‘Aṭṭār, Ḥasan, 339–340, 357–359  
 attraction, 18, 96, 97 n. 43, 99, 103, 106, 107,  
 110, 120, 122, 124, 128, 130, 133, 134, 234,  
 235, 460, 462, 463, 503  
 Augustine of Canterbury, 313  
 Augustinianism, 735  
 Austin, William, 699  
 Averroës (Ibn Rushd), 356  
 Avicenna (Ibn Sīnā), 110, 111, 147 n. 27, 164,  
 345–346, 369–372, 677  
 on ageing, 242, 250, 252, 257  
 and analogy, 10, 146, 379  
 on anatomy, 339, 342–346, 356, 358–359  
 on blood, 298–300, 305  
*Canon*, 20, 27, 33, 34, 35, 38, 298–300,  
 305, 348, 359, 363–392, 651–652  
 on embryology, 372, 379–380, 382–388  
 on fever, 174–176, 185  
 on the *humidum radicale*, 247 n. 26, 257  
 on *membra*, 363–392  
 and metaphors, 379–380  
 Bacchylides, 494  
 Bacon, Francis, 10–11, 17, 24, 98, 139, 142,  
 159, 160–161, 163–164, 167, 169, 171–172,  
 183–191, 208, 241–242, 259, 260 n. 70,  
 517, 529, 663  
 Baghdad, 342, 646  
 Baker, Henry, 544, 546  
 Barker, John, 210, 402 n. 22, 653 n. 87  
 Barry, Edward, 210  
 Bartholin, Thomas, 75, 77–78, 455,  
 463 n. 66, 464 n. 68, 470  
 Bary, René, 284–285  
 Basel, 75, 509, 571  
 Bassand, Joannes Baptista, 198  
 Basso, Sebastian, 98–99  
 Battus, Levinus, 37  
 Bauhin, Caspar, 8, 118–119, 120 n. 35, 122  
 Beeckman, Isaac, 580  
 Bellini, Lorenzo, 127, 134  
 Benedetti, Antonio, 35  
 Benzi, Ugo, 367, 373, 381, 387  
 Beraioonikij *see* Veronica  
 Berengario da Carpi, Jacopo, 19, 116, 122,  
 125  
 Berenice *see* Veronica  
 Berkeley, George, 229  
 Bernard, Claude, 5, 197  
 Bidloo, Govert, 532, 541  
 Black, Joseph, 221  
 blood  
 bloodletting, 213, 295, 297, 302–305, 452  
 cake, 302, 304  
 of Christ, 313, 419–20  
 cinders, 245  
 circulation of, 284, 418, 431, 435, 437  
 clotting, 295–305, 434, 467  
 coagulation of, 296  
 colours, 297, 300  
 Eucharistic, 312  
 globules, 200, 301, 534 n. 51  
 haematite (bloodstone), 328, 333  
 and humours, 508  
 and milk, 18, 427, 443, 445, 447–449,  
 466, 469–470, 473  
 movement of, 105, 434–35  
 pure and impure, 106, 107, 432, 435, 457  
 and semen, 20, 241  
 and serum, 119  
 and spirits, 17–18, 20, 279, 432  
 vessels, 20, 72, 103, 111, 122, 130–131, 211,  
 296, 298, 343, 453, 507, 634  
*see also* menstruation  
 body  
 and soul, 144, 393, 395, 406, 420, 431,  
 620, 661, 671, 678, 695 n. 34, 723  
 of fluids, 5  
 of organs, 5  
 Boeckel, Johannes, 36  
 Boerhaave, Herman, 5, 6, 15–6, 79 n. 26,  
 195–196, 198–214, 465, 472, 510  
 Bontekoe, Cornelis, 18, 443, 445–446  
 Bordeu, Théophile de, 270, 273–274, 281,  
 283, 285, 288  
 Bording, Jacob, 37  
 Borel, Pierre, 532  
 Borelli, Giovanni, 127–128, 131, 133–134  
 Botallo, Leonardo, 74  
 Bövingh, Johann Georg, 512

- Boyle, Robert, 168 n. 102, 541
- brain(s), 130, 195–216, 357, 433–434, 557  
 n. 24, 591, 596 n. 5, 600, 610, 621–622,  
 666–667, 669–670, 672, 675–679,  
 688–691, 701 n. 50, 702, 714, 718, 723  
 cognition and, 144, 204, 408, 591, 600,  
 669  
 Galen and Pseudo-Galen on, 31, 551, 552  
 n. 3, 557, 559 n. 32, 560–561, 564–566,  
 577, 629–659  
 in the Hippocratic Corpus and its  
 reception, 66–67, 70 n. 6, 72, 74–76,  
 78–79, 195–216, 634  
 metaphors for, 235, 280, 557, 677  
 and *sensorium commune*, 202–207, 600  
 and the spirits (*pneumata*), 143 n. 14,  
 146, 152, 161–162, 179, 280 n. 31, 346,  
 408, 428, 454, 557, 559, 564, 630,  
 632–633, 635, 636–641, 648–650, 667,  
 679, 689, 690  
 and vision, 551–567, 569–594
- breast(s)  
 in animals, 69–70  
 breastfeeding, 19, 73, 117, 125, 363–392,  
 443–478  
 and glands, 66–67, 77, 465  
 inflammation of, 471  
 and kidneys, 117–120, 125  
 male and female, 66, 458  
 and menstruation, 374, 449–452, 473,  
 687  
 structure, 454–455  
 sympathy with womb, 19, 450, 453–455,  
 465, 472–473  
 and the voice, 695–698
- Browne, Thomas, 447, 742
- Brun, Charles le, 278–280, 283–284
- Bruno, Giordano, 83, 98, 99 n. 53, 141, 482,  
 489
- Buffon, George-Louis (Marie) Leclerc,  
 203 n. 27, 235 n. 65, 237, 271, 609
- buffy coat, 296, 298, 301 n. 22, 303, 304
- Burnet, Thomas, 79
- Burton, Robert, 60, 235 n. 67, 630
- Busch, Amalia Rheinholdina, 606, 607 n. 51
- Caius, John, 65, 71
- calor innatus* (innate heat), 51 n. 31, 120  
 n. 35, 178, 186, 191, 247–248, 250,  
 253, 346, 427, 437, 456, 462, 506, 517,  
 637–638, 653 n. 86
- Calvus, Marcus Fabius, 71
- Cambridge Platonists, 71, 653 n. 88, 714  
 n. 7, 715 n. 15, 722, 742 n. 148, 743
- camera obscura, 18, 556 n. 20, 569, 570, 571,  
 572, 578, 581, 582, 584, 585, 586, 587, 590,  
 591, 592
- Campanella, Tommaso, 10, 11, 22, 141,  
 171–185, 188–189, 191, 193
- Capivaccio, Girolamo, 556 n. 20, 574
- Carl August, Prince, 601
- Carrère, Joseph-Barthélemy-François, 518
- Cassorius Placentinus, Julius, 556 n. 20,  
 575, 577
- Celsus, 30 n. 11, 321, 467, 562 n. 47
- Cesalpino, Andrea, 18, 20, 348, 415, 417,  
 429, 431, 432, 433, 434, 435, 437, 438
- Charleton, Walter, 467, 742
- Christ, *see* Jesus Christ
- Chronos, 333
- Chrysippus, 558, 562 n. 47, 635
- chyle, 19, 73, 77–79, 153, 432, 443, 460–461,  
 464–465, 468–469, 473, 503, 509, 672, 677
- Cicero, 61
- Clement of Alexandria, 498
- Cohn, Tobias, 9
- Colombo, Realdo, 126 n. 46, 339, 347 n. 27,  
 431, 435
- concoction, 144, 153, 165, 179, 346, 402,  
 427, 432, 434, 450, 460–465, 469, 505,  
 508–509
- concordia discors*, 405
- Constantine the African, 339 n. 1, 631, 649,  
 652 n. 84
- consumption, 68, 78, 256, 517
- continuity, 2, 11, 15, 22, 105, 132, 360, 385,  
 518, 529, 686, 692 n. 32
- Cornarius, Janus, 71
- corpuscularianism, 84, 92, 95, 96, 97  
 n. 42, 100
- cosmic harmony, 394, 405
- Cowper, William, 532, 534, 541
- cribrum*, 112, 121, 124, 118 n. 29
- Crollius, Oswald, 168
- Crooke, Helkiah, 454, 457, 460–462, 531,  
 690–692, 695–698
- Cudworth, Ralph, 16, 22, 713–747
- Cullen, William, 218, 219 nn. 6–7, 221, 226,  
 232, 235, 237
- Cunningham, Andrew, 2–4, 7, 41, 196–197,  
 211 n. 54, 231, 419, 422, 432 n. 43, 525  
 n. 6, 538
- Dante, 652 n. 84
- death, 12, 50–51, 148, 156 n. 50, 161, 165, 183  
 n. 47, 207, 243, 245, 247, 250, 262,  
 284–285, 311, 345, 419, 424, 428, 482, 493,  
 496, 510, 514, 691, 704

- Democritus, 49, 68, 73, 76, 96, 98, 100, 553,  
554 n. 11, 715  
demonology, 408 n. 43  
*derma*, 481, 484–489, 491, 498, 500,  
528 n. 23, 529  
Des Chene, Dennis, 1  
Descartes, René, 1, 10, 13, 16, 205, 278–279,  
448, 531, 578 n. 31, 580, 586, 588, 610  
n. 63, 686 n. 4, 691–692, 713–714,  
716–717, 722, 742, 746–747  
Despars, Jacques, 367, 373, 381–382,  
385–386  
despiritualisation, 587  
Deusing, Anton, 73, 466  
Devereux, Robert, Earl of Essex, 188  
Diderot, Denis, 9, 211, 267–271, 273–275,  
281, 283–288  
Digby, Kenelm Edward, 742  
digestion, 56, 406, 174 n. 11, 178, 190, 250,  
253, 255–257, 400, 406, 633, 696, 701  
analogies and metaphors for, 13, 41, 59  
n. 60, 60, 246  
as concoction, 144, 165, 461–465  
embryology and, 363–392, 443–478  
old age and, 241, 248–250  
residues, 72, 157–158  
spirits and, 17, 144, 154–155, 166, 667,  
672  
*see also* Aristotle; liver; metabolism;  
organs  
Diocles of Carystus, 506  
Diogenes Laertius, 47, 89, 735  
Diogenes of Apollonia, 634  
Dionysius (Pseudo-), 743  
Dionysius of Alexandria, 313  
dissection  
animal, 7, 343 n. 14, 358, 639  
human, 2, 4, 36, 76, 346–347, 349, 435,  
447, 470, 528–529, 559, 563, 580–581,  
583, 597  
meaning of term, 491  
distillation, 9, 17, 139, 141–144, 146–148,  
150–153, 155, 156 n. 50, 157–158, 160–161,  
163, 165, 166 n. 98, 167, 348, 463  
divisions of medicine, 27, 29, 30  
Doni, Agostino, 98  
Donne, John, 9  
Dorn, Gerhard, 147  
double nature of man, 618, 621, 622  
dreams, 92, 94–96, 268, 552, 714  
dryness, 49–50, 52, 59, 69, 144 n. 18, 151,  
164, 244–245, 247–248, 252, 256, 297,  
299–300, 402, 427, 444, 492, 496, 518,  
664  
Duchesne, Joseph, 17, 139, 153, 155–156, 158,  
160, 167  
DuLaurens, André, 118, 120–123, 131,  
252 n. 42  
Duns Scotus, John, 743  
earthquake, 59  
Ebenfijis *see* Ibn al-Nafis  
eclecticism, 84, 87, 92, 96, 97 n. 43, 213,  
636 n. 23  
Edinburgh, 79, 208 n. 41, 219–221  
education, medical, 33, 614  
Elizabeth I, 188  
embryo, 10, 173 n. 11, 202, 363–364, 366,  
368 n. 20, 371–374, 376–377, 379–382,  
384–386, 388–389, 391, 448, 457–458,  
460 n. 55, 466–467, 635, 675, 713  
embryology, 68–69, 274, 363–364, 366–367,  
368 n. 20, 374, 389, 391, 466, 635  
emotions, 7, 8, 87, 236, 311, 393, 395,  
398–399, 410, 492–493, 496, 508, 520,  
614–616, 621, 622 n. 99, 686 n. 4,  
687–689, 691 n. 28, 692, 695, 698,  
699–700, 702–703, 708  
Empedocles, 49, 85, 100, 450, 527, 554  
Englert, Ludwig, 30  
Epicureanism, 85, 89, 92, 95 n. 40  
Epicurus, 31, 41–43, 46–47, 54–58, 85 n. 6,  
88, 90, 92, 94–97, 99, 553, 554 n. 11  
Erasistratus, 5, 30, 31 n. 15, 399, 635, 732  
Euripides, 71  
Eustachio, Bartolomeo, 118–119  
Eustathius of Thessalonica, 493, 495, 498  
exhalation(s), 48, 49, 50, 51, 52, 97 n. 43,  
247 n. 27, 284, 529  
exorcism, 332, 333 n. 58, 334–335  
experiment(s), experimental,  
experimentation, 2–3, 7, 11, 18, 196–199,  
241–266, 304, 416 n. 3, 443–478, 532,  
596, 631  
16th century, 116, 661  
17th century, 73, 76, 84 n. 4, 85 n.5, 122,  
125–126, 127–128, 130, 132–133, 160–162,  
168, 471–472, 506, 511, 534, 536, 541,  
544, 556 n. 20, 569–593  
18th century, 196–199, 203, 221, 225, 262,  
301, 472, 610, 613, 617  
experimental evidence, 132, 197, 472  
Galen and, 32, 109, 126, 132, 562–563,  
634, 638, 640  
self-experimentation, 183 n. 47  
eye(s), 6–7, 66, 72, 89, 156, 166 n. 99, 167  
n. 99, 212, 284, 286, 357, 433, 494,  
551–567, 569–593, 603, 686, 703, 718

- anatomy and dissection of, 18, 551,  
587–590  
blindness, 316  
diseases of, 551–552, 561–564, 595–626  
focusing, 220, 229  
glasses, 591  
oozing, 248, 496 n. 63  
and sweat, 510, 514–515  
*see also* tears  
eyelids, 6 n. 19, 94, 272, 561 n. 42, 564, 616
- Fabricius ab Aquapendente, Hieronymus,  
457 n. 45, 458, 556 n. 20, 575  
Fahraeus, 302–304  
Falconet, Etienne Maurice, 269, 271, 280  
n. 31, 281, 283–286  
Falloppio, Gabriele, 118–119  
fat, 10, 67, 71, 73, 115, 116 n. 24, 300, 366,  
370, 376, 382–384, 387, 389, 462,  
463 n. 66, 503, 508, 514, 691, 696  
Feijoo, Jerónimo, 681  
female, 6, 8, 19, 20, 36, 68, 145 n. 19, 307,  
324, 363–365, 366 n. 8, 367, 371–372,  
377–379, 382–383, 389–391, 403, 446,  
447–448, 451, 456, 459–460, 512–513,  
661–662, 669, 672–673, 675, 699, 702,  
706  
femininity, 364 n. 2, 365, 378, 382, 390,  
672, 674  
Ferguson, Adam, 220  
Fernel, Jean, 5, 21, 27, 28 n. 4, 33, 34 n. 30,  
35, 36, 37, 38, 172, 178, 179 n. 34, 242, 252,  
253, 416, 417, 457 n. 45, 529, 531, 540, 652,  
653 n. 86, 667 n. 16  
fever(s), 10–11, 67–68, 174–176, 178–180,  
185–187, 191, 195, 244, 256–257, 301, 304,  
395–396, 411, 452, 509–510, 512–513,  
515–516, 519, 565, 608, 614, 708  
Ficino, Marsilio, 11, 17, 19, 139, 141, 149, 150,  
151, 152, 153, 159, 160, 164, 167, 249 n. 32,  
255 n. 54, 393–412, 432  
filters, 85 n. 8, 103, 107, 109, 112, 113,  
116 n. 24, 117, 119, 120, 124, 125, 127, 131,  
132  
Flachsland, Caroline, 605 n. 46  
fluid(s), fluidity, 18–20, 77, 105 n. 2,  
107–109, 120, 125–128, 130, 132–133,  
135, 180, 252, 296–300, 374, 393, 405,  
432, 434–435, 443–478, 503–522, 588,  
613–614, 618, 622, 645, 669, 676, 687, 719  
bodily texture, 494–497  
Boerhaave on, 200, 205–210, 212–213  
lymphatic, 72  
movement and stagnation of, 5, 6, 72,  
206, 525, 529, 532, 534, 536, 538, 540  
humoral, *see* humours, and under indi-  
vidual humours  
non-humoral, 6, 156, *see also* milk;  
semen; spirits; sweat; tears; urine  
nervous, 600, 610  
and *pneuma* or spirits, 561, 663, 667  
flux, 10, 66, 70, 74–75, 77, 79, 279, 284, 446,  
452, 469, 489, 494, 555, 692, 707  
bodily, 72  
Foesius, Anutius, 65, 71, 80  
food(s), foodstuff(s), 50–51, 56, 69–70, 144,  
154, 157, 178, 210, 252–253, 255, 364–365,  
370–372, 374–375, 377–378, 383,  
386–387, 389–391, 400 n. 20, 420, 427,  
432, 444, 454, 455 n. 37, 457–458,  
460–466, 469, 493, 505, 510, 544, 564,  
632, 697, 725  
Fracastoro, Girolamo, 83, 96, 97 n. 43,  
667 n. 16, 673, 678  
Franklin, Kenneth, 28, 33, 35, 38  
Froidmont, Libert, 579
- Galen, 4–5, 16–19, 27, 29–32, 80, 86, 96,  
153, 203–204, 250, 395, 407, 415, 424, 426,  
429, 431–433, 526, 597, 689, 713, 718, 732,  
746–747  
on ageing, 242–245, 248–250, 252,  
256–257  
and analogy, 244–245, 256  
on anatomy, 36, 453 n. 33, 551  
on blood and movement of the blood,  
297–298, 303, 339–362, 431, 434–435,  
437–438, 468–469  
Boerhaave on, 208, 213  
and dissection, 4, 7, 16  
embryology, 364–366  
on experiments, 109, 126, 132, 634, 640  
on *facultas formatrix*, 732–733  
on generation, 8, 372, 379, 732–733  
on glands, 69–70, 73, 76  
on the Hippocratic Corpus, 67  
on the kidneys, 18, 103–137  
on matter, 86–87  
and metaphors, 243, 249  
on *phusilogia*, 27–40  
on *pneuma*, 629–659  
on the skin, 485, 490, 526–527, 541  
on sweat and urine, 19, 504–508,  
510–511  
on teleology, 634  
on vision, 551–567, 569, 572–575

- Galenic, Galenist, 9, 19–20, 27, 36, 70, 123, 242, 247, 394, 426, 448, 503, 525, 531, 551, 666, 671, 689, 742–743  
 embryology, 363–392, 455 n. 37, 456 n. 42  
 on the heart, 284, 654, 714 n. 6  
 opposed to Hippocratic medicine, 209  
 on the humours, 444–445, 472, 613 n. 73  
 on the liver, 79, 426, 639, 640, 640–641  
 on the spirits, 20, 279, 285, 344, 347, 426, 433, 629–659, 666, 744  
 on vision, 569–593  
 Galenic Corpus, 35, 344, 553, 556, 646, 664  
 Galenism, 4, 17, 499, 577, 629, 641–643  
   late-antique, 27, 32–33, 38, 647  
   medieval, 27, 34, 110–111, 257, 363–392, 429, 662  
   neo-, 34, 121, 153, 168 n. 102, 178, 241, 262 n. 80  
 Garrick, David, 271  
 Garzoni, Tommaso, 142  
 Gassendi, Pierre, 89 n. 17, 580  
 Gentile da Foligno, 367, 373–374, 376, 380, 384  
 Giles of Rome, 364 n. 1, 366  
 gland(s), 6, 10, 17, 65–67, 69–70, 71 n. 7, 72, 75, 77–80, 123–124, 129, 131–132, 274, 279, 454, 458 n. 49, 460, 465, 506, 518, 532, 534, 540, 602, 605 n. 44, 610, 613, 616, 621  
   lachrymal, 6, 613  
 Glisson, Francis, 77, 653 n. 88  
 Goethe, Johann Wolfgang von, 601, 604, 606–607  
 Golding, Arthur, 706, 707  
 Golitsyn, Dimitry Alekseevich, 283  
 Golius, Jacobus, 579  
 Graaf, Reinier de, 197–198  
 Gregory the Great, 313  
 Grew, Nehemiah, 523, 525, 536–537, 540, 544  
 Guarinonius, Hippolitus, 516  
 Guintier d'Andernach, Jean, 113, 115, 347 n. 27  
 Gutermann, Georg Friedrich, 453  
 Haemorrhoida, 19, 307–312, 314, 316, 321, 325, 328, 333–335  
 Hall, Thomas, 1, 28  
 Haller, Albrecht von, 3, 22, 198, 202, 203 n. 27, 271, 302, 513, 544 n. 77, 595, 596 n. 5, 598, 600, 602, 609, 610 n. 63, 611, 613, 614, 616, 619, 620, 622  
 Haly Abbas *see* al-Majūsī  
 Hartknoch, Johann Friedrich, 608  
 Harvey, William, 4, 5, 9, 13, 16, 21, 71, 73–74, 105, 119, 120 n. 35, 121, 123, 125, 126 n. 46, 127, 130, 172, 179, 188, 197–198, 202–203, 205, 210, 213–214, 301, 339, 341, 360, 415, 417, 462, 466, 467 n. 79, 468–470, 519, 578, 585–586, 630, 653, 713–714, 740–744, 746–747  
 healing, 4, 10, 19, 175, 178, 307–308, 310–311, 314, 316, 321, 324–325, 328, 334–335, 393–394, 399, 407, 411, 435, 607, 617, 619  
 heart, 2, 17, 20, 50 n. 31, 70, 72, 89, 98, 112, 120, 122, 126 n. 46, 130, 142, 143 n. 14, 152, 154, 163, 173 n. 11, 178, 195–196, 201, 203, 207, 212, 284, 341, 343–348, 351, 356, 358, 360, 376, 399–400, 406, 408, 415, 418, 420, 424, 426, 428–429, 431–435, 437–438, 456, 458, 464 n. 70, 465, 468, 470, 492–493, 566, 573, 585, 616, 630, 632–633, 636–641, 647–650, 653–654, 667, 672, 689, 694, 695, 701 n. 50, 714, 718, 742  
 Hekhalot Rabbati 18, 312  
 Helmont, Jan Baptist van, 16, 176, 472, 713, 744  
 Helvétius, Claude Adrien, 268  
 Hemsterhuis, Frans, 281, 286  
 Henry IV, King of France, 153  
 Heraclitus, 735, 737 n. 122  
 Herbert of Cheshire, 742  
 Herder, Johann Gottfried von, 22, 595–622  
 Herophilus, 5, 557, 635  
 Heurnius, Johannes, 556 n. 20  
 Hipparchus, 554  
 Hippocrates, 429, 642, 735, 744  
   and Aretaeus, 212  
   appeals to, 29  
   Boerhaave as new Hippocrates, 201  
   and chemical medicine, 153  
   and Democritus, 68, 79  
   Early Modern approaches to, 66, 71–78, 129, 209  
   as Father of Medicine, 208, 211  
   Galen on, 31–32, 67, 70, 248–249, 494  
   and Harvey, 16, 210, 213, 740  
   on humours, 51, 72, 88, 248, 445–446, 472–473, 614 n. 73  
   and observation, 208, 213, 296  
   and Plato, 31  
 Hippocratic Corpus, 489, 494, 526, 634, 642–643  
   centrality of brain, 196, 203–204

- critical days theory, 177  
 date and authorship, 67–8, 73, 209  
 gynaecology, 68, 73, 332, 450, 455,  
     457–458, 696, 701 n. 50  
 heat in, 175, 247  
 letters in, 68–9, 73  
 Hippocratic method, 209–210  
 Histiaeus of Perinthus, 554 n. 12  
 Hobbes, Thomas, 717, 722  
 Hoffmann, Friedrich, 513  
 Holbach, Paul-Henri Thiry, Baron d', 268  
 Homer, 481–484, 489–490, 491 n. 33, 492,  
     493 n. 50, 494, 496 n. 63, 497, 499–500  
*homo patiens*, 618  
 Hooke, Robert, 465, 534, 544, 742  
 Horne, Johannes van, 65, 73, 75, 78  
 Horus, 325  
 Huarte de San Juan, Juan, 681  
 Hufeland, Christoph Wilhelm, 600, 607, 618  
 Hülägü Khan, 342  
 humanism, 267 n. 1, 412, 432 n. 45  
 Hume, David, 11, 16, 21, 217–218, 219 n. 6,  
     221–238  
 humidity, humid, 154, 245, 434, 444,  
     459 n. 53, 463, 676  
 humours, humoral theory, 5–6, 7, 31, 32,  
     34, 51, 68, 72, 79, 83, 88, 129–130, 172,  
     298, 301, 304–305, 450, 471, 473, 510, 514,  
     647, 666, 672, 677, 679  
     aqueous and crystalline humours in eye,  
       559, 564, 575, 585, 588, 590–591  
     in Bacon, 185–186  
     balance of, 19, 406, 426, 632, 704  
     in blood, 427  
     in Boerhaave, 200  
     and distillation, 148, 157  
     and food, 374–375, 387, 564  
     four, 18, 144 n. 18, 153, 168, 248, 302–303,  
       305, 396, 400, 402 n. 22, 403, 423, 426,  
       427, 444, 614 n. 73  
     and medical practice, 302, 452  
     and organs, 21  
     and passions, 424, 688–689  
     serum as a humour, 507, 517  
     and 'spirits', 141, 143, 408, 432, 509,  
       689–690  
     sweat as a humour, 505  
     three, 153  
     two, 181  
     *see also* under individual humours  
 Hunayn ibn Ishāq (Johannitius), 33, 345,  
     629, 643, 645–646, 649  
 Hunter, William, 3  
 Hutcheson, Francis, 222  
 Huygens, Constantijn, 581, 584  
 hydraulic body, 19, 443, 470–472  
 hysteria, 328, 332, 335, 686 n. 1, 701 n. 50  
 Ibn Abī Uṣaybi'a, 343  
 Ibn al-Makkī, 348  
 Ibn al-Nafīs, 16–17, 21, 30, 339–343,  
     345–350, 356–359  
 Ibn Sinā, *see* Avicenna  
 Ibn Ṭufayl, İtākī *see* Şemsettin İtākī  
 impurity, 311, 314, 335, 457 n. 45  
 innate heat *see* *calor innatus*  
 İtākī *see* Şemsettin İtākī  
 Jacopo da Forlì, 367, 368 n. 20, 373, 374,  
     378, 379, 380, 383, 384, 386, 387, 388  
 Jairus, 308–310  
 James I, King of England, 188  
 James, Robert, 211, 506  
 Jesus Christ, 19, 307, 309–311, 313–314, 321,  
     324–325, 328, 333–334, 390, 418–420,  
     423, 429, 509  
 Joannitius *see* Hunayn ibn Ishāq  
 John of Alexandria, 32, 644–645, 647 n. 61  
 Jonas of Orléans, 313  
 Jorden, Edward, 701  
 Judaism, 311–312  
 Juvenal, 620 n. 94  
 Kant, Immanuel, 595, 598, 609, 611  
 Kepler, Johannes, 566, 570 n. 6, 571, 573,  
     585 n. 55, 587, 590–592, 742  
 Khunrath, Heinrich, 147  
 kidney(s), 8, 18, 21, 66–67, 103–135, 157,  
     505, 507  
 al-Kindi, 399–400, 403  
 lactation, 73, 448–452, 456, 465, 473  
     male, 451, 460  
     *see also* breast; milk  
 Laocoön, 275, 277–280, 283–284, 286  
 Laurentius, Andreas, *see* DuLaurens, André  
 Lavater, Johann Caspar, 600  
 Lazarus, 324  
 Leeuwenhoek, Antoni van, 301, 523, 525,  
     537, 544  
 Leibniz, Gottfried Wilhelm, 182, 191  
 Leiden, 6, 74–75, 205, 208, 213, 219, 281,  
     579, 581  
 Lémery, Louis, 465 n. 71  
 Lessing, Gotthold Ephraim, 277, 286, 288,  
     615 n. 75  
 Leucippus, 96, 553 n. 10  
 life, seat of, 422

- Linacre, Thomas, 632, 732  
 Linden, Johannes Antonides van der, 65, 74  
 liver, 73, 77, 79, 130, 154, 298–299, 346–347, 376, 382, 399, 408–410, 426, 432–433, 614, 645, 654, 704  
   in digestion, 157, 351, 432, 461, 463–464, 468–470, 505, 509, 633, 638–642, 667, 672  
   in divination, 70–71  
   in embryology, 457–458  
   as food, 69  
   as one of three principal organs, 178, 630, 638, 648–650  
 Lobstein, Johann Friedrich, 603, 605  
 Lombard, Peter, 390–391  
 London, 78, 260, 422, 424, 460, 525, 540, 732  
 Lucretius, 13, 16, 41–42, 54–58, 60, 83–100  
 lung(s), 66, 78–79, 146, 157, 196, 207, 252, 400 n. 20  
   as cooling the heart, 163, 435  
   in Galen, 633, 637, 640–641  
   as noble parts, 376  
   as organs of consciousness, 492  
   as organs of elimination, 252  
   pulmonary transit, 339–360, 431, 432, 435  
 Lycurgus, 181  
 Lygaeus, Johannes, 36  
 lymph vessels, 72, 75  
 lymphatic system, 65–66, 69, 72, 78–79, 468 n. 83, 470  
  
 machine, body as, 11, 130, 202, 204, 205, 232, 246, 257, 273–274, 471, 472  
   *see also* mechanistic models of the body  
 Machiavelli, Niccolò, 180–182, 184, 190 n. 68, 191  
 magic, 15, 150 n. 36, 308, 311, 321, 334, 570, 584  
 al-Majūsī, ‘Alī ibn al-‘Abbas (Haly Ab(b)as), 339, 356, 651  
 male, 8, 365, 367, 371, 377, 379, 390–391, 403, 446, 451, 460, 465, 673, 685, 692, 696, 698–699, 702–703, 705, 708  
 Malebranche, Nicolas, 229  
 Malpighi, Marcello, 21, 103, 105–106, 126, 130–133, 135, 202, 506, 532, 541  
 Marcellinus, 314, 321  
 Mary St., 328  
 Mary Magdalene, 316  
 masculinity, masculine, 363, 365–366, 377–378, 503, 703  
  
*Matthew*, Gospel of, 334  
 Maupertuis, Pierre-Louis Moreau de, 268  
 Maurus of Salerno, 299–300  
 Mead, Richard, 619  
 mechanistic models of the body, 16, 18, 19, 21, 24 n. 42, 84, 87, 94, 144, 186, 191, 199–200, 224, 231–235, 246, 257, 262, 271–274, 279–280, 283–284, 472, 508, 531, 538, 586, 663, 713–748  
   and digestive system, 470  
   failure of model, 218–221  
   and glandular system, 129–130  
   and the passions, 691–692  
   and skin, 541, 546  
   and urine production, 106–110, 116, 125, 126–127, 131–135  
   *see also* machine, body as  
 medicine, medieval, 257, 302, 373, 376, 385, 396 n. 9, 412  
 melancholy, 249 n. 32, 408 n. 42, 614 n. 73, 616, 685–689, 692–694, 698, 702, 704–705, 708–709  
 membra  
   sanguinary, 363, 365–367, 375–377, 380, 382, 384–389  
   spermatic, 363, 366, 376–377, 380–389  
 menstruation, 246, 311, 332 n. 48, 379, 383–384, 457, 517  
   and healing, 307  
   and lactation, 448–455, 473  
   male, 451 n. 27  
   and purity, 19  
   suppressed, 512  
   taboos, 312–314, 334  
   vicarious, 703, 704 n. 54  
 Ménuret, Jean-Joseph, 270, 274, 283, 288  
 Mercuriale, Girolamo, 523, 525–527, 529  
 Mersenne, Marin, 544, 580, 691  
 metabolism, 155, 457, 661–683  
 meteorology, 10, 13, 42, 48, 58, 173 n. 11  
 Mettrie, Julien Offray de La, 268, 270  
 microscopy, 16, 85, 262, 506 n. 17, 523, 532, 534, 538, 544  
 Middleton, Thomas, 697–699, 702  
 milk, 70, 73, 78, 296, 297, 365, 374, 382–383, 427, 685, 687, 694, 698  
   analogy with blood, 18  
   in embryology, 10, 19, 379–380, 675  
   and sweat, 509  
   and urine, 19, 117, 120, 124–125  
   as ‘white blood’, 18, 443–473  
   *See also* lactation  
 miracle, 15, 308, 316, 321, 325, 335, 382



- Moffett, Thomas, 443, 445  
 moisture, moist, 49–51, 55, 66, 70, 75,  
     78–79, 120, 129, 144 n. 18, 151, 154, 241,  
     244–250, 252–253, 255, 259, 391, 402 n.  
     22, 427, 454, 462–464, 493–496, 515, 517,  
     617, 664  
 Monnier, Pierre, 280  
 Monte Cassino, 649  
 Monte, Giambatista da, 652 n. 85  
 Moses, 31, 311, 321, 428  
 Mosheim, Johann Lorenz von, 713, 732,  
     740–741  
 motion(s), 1, 3, 9–10, 50–51, 53–54, 72, 89,  
     127, 168, 171, 178–182, 184–191, 195–196,  
     200–201, 204, 207, 210, 212, 219–220,  
     228–229, 255, 280 n. 31, 285, 471–472, 538,  
     555–556, 634, 637–638, 667–668, 670, 675,  
     679, 714–715, 718, 722–723, 735, 738, 746  
     celestial, 181  
     circular, 72, 347–348, 404, 407, 527  
     of heart, 126 n. 46, 348, 406–407, 714  
     involuntary, 204  
     perpetual, 180, 407  
     and *sensorium commune*, 196, 207  
     and sight, 210–220, 229  
     of spirits, 160, 166 n. 99, 280 n. 31, 630  
     in the womb, 455  
 mouth, 51, 79 n. 26, 154–155, 166 n. 99, 195,  
     212, 284, 347, 364, 378 n. 57, 420, 451,  
     464, 467, 510  
     of the womb, 378  
     analogy between mouth and womb,  
         695–697, 705  
 Muḥammad ‘Alī Pasha, 357  
 Murat IV, 350  
 musical therapy, 393–394, 396, 403–404, 412  
 Myrepsus, Nicolaus, 334  
  
 Needham, Walter, 466  
 Neoplatonism, 141, 149, 150, 159, 167, 260,  
     715 n. 15, 739, 743, 745 n. 163  
 Newton, Isaac, 16, 134, 217–218, 226,  
     233–234, 424 n. 26  
 Newtonianism, 199 n. 14, 217, 226, 234–235,  
     237, 273  
 nose, 6 n. 19, 66, 72, 79 n. 26, 146, 156, 195,  
     212, 488 n. 24, 605–606  
 nosebleeds, 311, 334, 451, 514, 703–704  
 novelty, 11, 41–42, 58, 61, 275, 324  
 nutrition, 1, 19, 20, 405, 448, 450 n. 22, 538,  
     633, 679, 725, 728, 732, 744  
     in animals, 55  
     and Boerhaave, 200, 210  
  
     and embryology, 363–391, 456–461, 467  
     and Harvey, 468–469  
     and Lucretius, 87  
     stages of, 464, 638–639  
     and tears, 493  
  
 obesity, 509  
 observation, 7, 9, 15, 17, 47, 66, 71 n. 7,  
     77, 85, 94, 112, 119, 121, 130, 145, 155, 162,  
     243–244, 248, 256, 269–271, 403, 423,  
     434, 455, 512, 519, 538, 577, 661  
     astronomical, 187, 403  
     of blood clotting, 296, 299–305  
     clinical, 260, 504, 519  
     in Galen, 32, 108, 298, 558–559, 562–564  
     in Hippocratic corpus, 209, 213, 296  
     with microscope, 471  
     *see also* microscopy  
 Opstal, Gérard van, 277–278, 280  
 organs, 5, 7–8, 130, 146, 171, 178, 189,  
     202–203, 227, 250, 273–274, 345, 365,  
     433–434, 444, 454, 457, 471, 614, 635, 697,  
     701, 732  
     and anatomy, 36  
     colour, 70  
     of consciousness, 493, 500  
     digestive, 60, 155, 157, 166, 458  
     excretory, 107–108, 120–121, 127  
     in Galen, 32, 566, 640, 646  
     irritability of, 602  
     sensory, 93, 143 n.14, 206, 229, 274, 404,  
         560, 666  
     *see also* under individual organs  
 organ, musical instrument, 235, 288  
 Origen, 313, 324  
 Ovid, 706  
  
 Padua, 9, 71, 75, 341, 348–349, 431, 468, 575,  
     579, 671, 742  
 Pansa, Martin, 514  
*papillae*, 103, 105, 116–118, 120, 122–125, 131  
 Paracelsus, 16, 139 n. 2, 143, 147, 155, 157–158,  
     166, 168, 208, 438, 448, 472, 713, 744  
 Paré, Ambroise, 452 n. 28, 529  
 Paris, 36, 76, 113, 153, 267, 349, 357  
     Medical Faculty, 33–34, 652  
     Royal Academy, 9, 269–270, 275  
     University of, 121  
 pathology, 30, 66–68, 70, 174, 176, 241 n. 1,  
     248, 257, 262, 302–305, 412, 512, 518, 552,  
     561, 575, 607, 614, 662  
     humoral, 302, 614  
     of ageing, 241

- patient(s), 15, 174, 272, 281, 283–284, 286, 395–396, 399, 403, 411–412, 512–519, 524, 538, 563, 565 n. 61, 606, 616, 618, 622  
and Boerhaave, 198, 207, 209, 214  
*see also* observation
- patients' letters, 504, 540
- Pecquet, Jean, 73, 76, 78, 470
- Peiresc, Nicolas-Claude Fabri de, 580
- perception(s), 47, 88, 186, 203–204, 212, 222–231, 280, 393, 447, 493 n. 50, 496, 519, 560 n. 38, 591, 663, 666, 668, 717, 723, 725, 735, 747  
and emotions, 410, 613, 619–620  
sensory, 96, 97 n. 43, 143 n. 14, 178, 203, 205, 212, 273–274  
visual, 556, 557
- Pergamum, 629–630, 642
- Peripatetics, 31 n. 15, 145, 500 n. 78, 744
- Persio, Antonio, 667, 681
- Peter, St., 314, 321
- Petitus, Petrus, 6
- Peyer, Johann Conrad, 77
- Philodemus, 61 n. 65, 94 n. 35, 95 n. 40
- phlebotomy, *see* blood
- physiology, 68, 70, 85, 95, 96, 122, 127, 141, 143, 153, 160–161, 167, 187, 213–214, 273, 344  
of ageing, 241, 243, 246, 249, 257, 259, 264  
as 'animated anatomy', 3, 202  
corpuscular, 100, 127, 715  
definitions of, 1–2, 3–5, 10, 22, 27, 29, 42, 58, 85, 92, 171–173, 183, 186, 189, 196–197, 199–200, 202, 238, 400, 416, 715, 726  
of dreams, 88  
experimental, 3, 197, 416 n. 3, 443, 470–471, 596  
Father of, 5, 38  
histories of, 1–2, 7, 9, 15–20, 28, 30–32, 36–38, 71, 84, 86, 105, 110–111, 205–206, 218–219, 229, 248, 268, 444, 471–472, 518–519, 534, 599, 631  
of sight, 551–566, 572, 577, 579  
theoretical, 632, 654
- Pindar, 494
- Pitcairne, Archibald, 134
- plagiarism, 37, 348, 359, 670
- plague, 78, 163–164, 287, 410–411, 499
- Plato, 16, 31, 68, 86, 149, 163, 208, 242, 259, 393–395, 400 n. 20, 403–405, 407, 409–410, 412, 433, 482, 526–527, 531, 534, 541, 554–555, 573–574, 639, 671–672, 713, 715, 721, 723, 729–730
- Platter, Felix, 571–572, 582
- Plempius, Vopiscus Fortunatus, 18, 566, 569, 572, 578–585, 587–588, 590–592
- plethora, 452, 459, 509
- plexus  
choroid, 636  
retiform, 179, 632–633, 637, 640
- Pliny the Elder, 6, 94, 95 n. 39, 467, 671
- Plotinus, 16, 149, 713, 729–730, 732–734, 737–739, 741, 743, 746–747
- Pluche, Noël-Antoine, 221
- Plutarch, 61, 553, 555, 635
- pneuma, 253, 279, 347, 356, 556–557, 586, 630–631, 687, 692, 702  
circulation of, 552 n. 3, 557, 559, 561  
natural, 17, 629, 631–633, 635, 638–641, 645–646, 648, 652 n. 85, 653  
psychic, 632, 633, 635, 636, 639, 640, 645, 648, 654  
Stoic theories of, 143 n. 14, 558, 634–635, 736–737  
visual, 18, 551, 558, 565, 576  
vital, 559, 632, 635–637, 640, 645, 648  
*see also spiritus*
- pneumatism, 636 n. 23
- pneumatology  
tripartite, 629, 641, 648, 650–651
- pollution, 503, 511
- pores, 255, 464 n. 69, 471  
in cardiac septum, 112, 349, 431, 435  
in renal sinus, 112, 116, 124, 128, 132, 134  
of skin, 17, 128, 505–509, 513, 515, 517–518, 523–548
- Porret, Christiaen, 581
- Porta, Giambattista della, 148, 566, 569–571, 584, 587, 590
- Porterfield, William, 219–220, 229, 232
- Presocratics, 68
- primordia*, 85, 88, 100
- principia*, 85, 88, 100, 173, 664
- printing, 35 n. 36, 74, 140, 357
- psychology, 58, 87, 90, 97, 143 n. 14, 173 n. 11, 226, 273–274, 280, 285, 287, 344, 368, 394, 403, 427, 494, 600, 611–618, 631–639, 652, 654, 666–667, 685–688, 686 n. 4, 692 n. 32, 694, 688, 690, 700, 708, 716, 725
- pulse, 11, 72, 179, 272, 393–412, 433, 435, 544, 650
- Pythagoras, Pythagoreans, 177, 247 n. 28, 398, 410, 484, 489, 554 n. 14
- Qalāwūn, Mamlūk Sultan, 343
- Quintilian, 61

- al-Qurashī, *see* Ibn al-Nafīs  
 Qustā ibn Lūqā, 345
- Ramazzini, Bernardino, 454  
 Ravenna, 321  
 respiration, 28, 207, 400 n. 20, 407, 433,  
   435, 527, 529, 538, 541, 546, 632, 635,  
   696, 697, 714  
 Rhazes (al-Rāzī), 356, 558 n. 28  
 Riolan the Younger, Jean, 76, 105, 121  
 Rolfinck, Guerner, 77  
 Rudbeck, Olof, 71, 75, 470  
 Rudolf II, 571  
 Rueff, Jacob, 457 n. 47  
 Rufus of Ephesus, 124  
 Rupescissa, Johannes de, 143, 149, 151  
 Ruysch, Frederik, 79 n. 26, 199 n. 10, 213,  
   262
- Sabuco de Nantes y Barrera, Oliva, 6, 18,  
   20, 661–663, 669–681  
 Šalāḥ al-Dīn (Saladin), 343  
 Salerno, 299, 305, 631, 649–650  
 Santorio, Santorio, 506, 511, 544 n. 75  
 Savonarola, Michele, 142, 146  
 Schegk, Jacob, 742  
 Scheiner, Christoph, 571, 573, 587, 588  
 Schneider, Conrad Victor, 75  
 Schwartz-Erla, Johann Christian, 609  
 Scot, Michael, 372  
 semen, 6, 18, 20, 70, 98, 145–146, 241, 253,  
   256, 345, 363–366, 371–373, 375, 377–382,  
   386–387, 389–391, 446, 456, 459 n. 53,  
   667, 674–675, 677–679, 687  
   female, 20, 363–367, 370–371, 377–381,  
     383, 390  
   male, 10, 363–366, 370–372, 377–382,  
     389–390, 456, 462, 640  
 Şemsettin İtaki, 21, 339, 340 n. 3, 350, 351,  
   356, 357, 359  
 Seneca, 49 n. 25, 58–60  
 Sennert, Daniel, 99, 742  
 serum, 18, 107–108, 112, 118–120, 122–124,  
   127–128, 200, 295, 299, 302, 304, 593,  
   507–508, 517  
 Servet, Miguel, 21, 339, 341, 347–349, 359,  
   431, 667 n. 16  
 Severino, Marco Aurelio, 76, 78  
 Shakespeare, William, 445, 685, 704, 711  
 Sharp, Jane, 455  
 Sharpey, William, 5  
 Sherrington, Sir Charles, 27, 35 n. 36  
 Short, Thomas, 508
- sieve, 18, 107–108, 112, 115, 117 n. 27, 118, 121,  
   124, 127, 131–134, 507  
*simulacra*, 93, 96  
 skin, 8, 16, 18, 166 n. 99, 244, 252, 429, 481,  
   484–490, 494–495, 498–500, 505–509,  
   512–518, 520, 523–529, 531–532, 534,  
   536–538, 540–541, 544, 546  
 Smith, Adam, 220  
 Sömmerring, Samuel Thomas von,  
   600 n. 26  
 Soranus of Ephesus, pseudo-Soranus, 29, 32  
 soul, 143 n. 14, 144–145, 212, 224, 253, 273,  
   277, 278–280, 285–287, 343–347, 364,  
   386–387, 393–395, 398, 420–423, 431,  
   434, 462, 481, 482, 494, 553, 602, 611, 615,  
   617–622, 634–635, 687–689, 693, 707,  
   713–716, 729–737, 740–748  
 Aristotle on, 51, 98, 368–372, 433, 456,  
   555–556, 566, 573, 667, 695, 719–720,  
   723–724, 737, 739, 746  
   as consciousness, 22  
 Ficino on, 141, 150, 152, 159, 403–410  
 Galen on, 31, 433, 566, 632, 638–641,  
   652–653, 744  
 generative capacity, 373  
 von Haller on, 202  
 Lucretius on, 57, 89, 93, 97–98  
 Plato on, 400 n. 21, 433, 555, 632,  
   719–720, 721–723, 741  
 Sabuco on, 671–672, 675–678, 679–680  
 Telesio on, 98, 664, 666, 667–669  
   *see also sensorium commune*
- Spenser, Edmund, 698  
 sperm *see* semen  
 Spiegel, Adriaan van de, 74–75, 579  
 Spinoza, Baruch de, 717  
 Spirit, Holy, 347, 426, 437, 438  
 spirits, 17–18, 34, 59, 141, 146 n. 22, 148,  
   151–152, 153–155, 172, 186–190, 207,  
   211–212, 213, 233, 284–285, 426, 508–509,  
   517, 520, 529–532, 576, 578, 630, 653, 663,  
   688–690, 693, 695, 707–708  
   visual, 575, 581, 587, 588, 590, 591  
   as 'vital virtues', 666  
   *see also* distillation
- spiritus*, 7, 98, 141 n. 8, 143, 145, 152, 157–167,  
 178–179, 246, 252, 259, 260, 428, 433, 476,  
 641, 653, 663, 666–667, 675  
 blood as vehicle of, 166, 246, 406, 408,  
   416, 522, 424, 426, 437  
 essence of life, 155, 156  
 four kinds, 426  
 and mercury, 153

- mundi*, 151  
 musical, 407  
 three kinds, 20, 168, 179, 347, 629, 630,  
     544–645, 647–648, 649–651  
 two kinds, 186  
*see also* *pneuma*; spirits  
 Stensen, Niels, 6, 79 n. 26, 506, 532  
 Stephanus of Alexandria, 32, 644, 645  
     n. 52  
 Stephanus of Athens, 647 n. 61  
 Stobaeus, 553, 554 n. 12  
 Stoic(s), 16, 30, 31, 143, 213, 500 n. 78,  
     551, 554 n. 14, 558, 562 n. 47, 634–636,  
     653, 673 n. 32, 680, 713, 717, 734–738,  
     740–741, 746–747  
 Storch, Johann, 447, 473  
 Swammerdam, Jan, 197  
 sweat, 8, 93, 503–520, 524, 529, 531, 544,  
     701  
     analogies for, 19, 49, 55  
     and blood, 349, 406, 509 n. 32, 687  
     physiology of, 16–17, 532–538  
     as a remedy, 541  
     and spirits, 162  
     and tears, 406, 446, 452  
     and urine, 49, 52, 117, 128, 298, 452, 466  
 Sylvius, Jacobus, 36  
  
 al-Ṭaḥṭāwī, Rifāʿa, 357  
 Tansey, Tilly, 3, 596 n. 4  
 tears, 6–7, 19, 406, 446, 452, 493, 496, 500,  
     511, 614–618, 621–622, 685–687, 695  
     n. 34, 703, 704  
     blocked tear duct, 22, 561 n. 42,  
     595–613  
     in epilepsy, 212  
 Telesio, Bernardino, 17, 21, 83, 98, 178,  
     661–669, 671–681  
 Theodore of Tarsus, 313  
 Theophrastus, 58, 90 n. 24, 91 n. 26, 557  
 Thurneisser, Leonard, 514  
 Tissot, Samuel Auguste, 513–514, 516,  
     540 n. 65  
 transpiration, 503–508, 511, 514–515, 527,  
     687 n. 5  
     insensible, 17  
 Trescho, Sebastian Friedrich, 609  
 Tulp, Nicolaes, 579  
 Turner, Daniel, 525, 540  
  
 urine, 452, 464, 466  
     analogies for, 19, 52  
     analysis of, 147, 444 n. 4  
     and sweat, 49, 504, 505, 507, 508, 511  
     history of, 103–135, 298–299  
     *see also* *uroscopy*  
 uroscopy, 147, 296, 301, 511  
 uterus  
     charms to heal, 328–332  
     as cold, 677  
     communication with breasts, 19, 450,  
         453–454, 472  
     and conception, 374–375, 377, 449, 456,  
         457–458, 460, 675, 713  
     haemorrhage from, 316, 333, 335  
     as hot, 456  
     humours in, 374  
     mobile, 332–333, 519  
     mouth of, 364, 378, 696–698  
     in pregnancy, 166, 365–366, 382, 385,  
         451, 453, 454–455, 458, 690–691  
     temperature of, 456, 677  
     terminology for, 8, 686  
     vapours from, 701  
     *see also* *menstruation*  
  
 Vaughan, William, 689  
 veins, 72, 99, 212, 347, 349, 376, 377, 400  
     n. 20, 404–406, 434–435, 453, 454, 458,  
     464, 529, 610, 630, 650, 718, 719  
     analogical understanding of, 13–15, 60,  
     437, 471  
     cervical, 296  
     Galenic model of, 426–427, 432, 468,  
         632–633, 637, 639, 640, 641, 648, 654  
     and heart, 201  
     milk, 460, 466, 467, 469–470  
     renal, 103, 105, 106, 108, 109, 111, 112–118,  
         123, 125, 127–138, 130, 132, 153, 505  
     spermatic, 383  
     subclavian, 73  
 Veronica, 333–334  
 Vesalius, Andreas, 4–5, 21, 71, 112–113,  
     115–116, 118–119, 121, 341, 347 n. 27, 351,  
     415, 431, 453, 523, 528–529  
 Vimercato, Francesco, 100  
 Virchow, Rudolf, 295, 297, 302–303, 305  
 virtues, *virtutes*, 189, 387, 433 n. 46,  
     615–616, 644, 647, 649–651, 666  
 visualisation, 334, 400 n. 21  
 vitalism, 9, 21, 83–84, 86 n. 9, 218, 233, 267,  
     272 n. 17, 273, 275, 302, 504, 536 n. 55  
 Vives, Juan Luis, 689  
  
 Walaeus, Johannes (Wale, Jan de), 74  
 Wharton, Thomas, 77–78, 79 n. 26, 466

- Whytt, Robert, 219–220, 232  
Willis, Thomas, 168 n. 102, 467, 688, 690  
Wilson, Leonard G., 1, 28  
Winter of Andernach, Johann *see* Guinter  
    d'Andernach, Jean  
womb, *see* uterus  
Wright, Thomas, 688–690, 692, 694, 697  
Young, George, 220  
Zacharias, 333  
Zeno of Citium, 735  
Zerbi, Antonio, 116, 121, 245 n. 17, 250  
Zimmermann, Johann Georg von, 600, 619  
Zwinger, Theodor, 65, 71, 129